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VITAL AND MONETARY LOSSES IN THE UNITED STATES DUE TO TYPHOID FEVER.*

By William O. Mendenhall, *Professor of Mathematics, Earlham College,*
and
Earl W. Castle, *Instructor in Mathematics, University of Michigan.*

I.

The study outlined in this paper was made under the direction of James W. Glover, Professor of Mathematics and Insurance in the University of Michigan. Its object is twofold: first, to determine the vital and financial loss to a community due to typhoid fever; and second, to give an example of the construction of mortality tables by Sprague's Osculatory Method. This method of construction is treated in a paper by King.† By the method here described it is possible to represent the given data with remarkable accuracy, and to obtain at the same time a smooth graduation. More of detail will be given in the second part of the discussion, which deals with the construction of the mortality table, than in the first part, which concerns the determination of loss due to typhoid fever, since the method of finding the effect of a disease upon a community has been completely illustrated in a paper by Glover.‡

The statistics upon which the mortality tables are based are the enumerated population, aggregate male and female, June 1, 1900, obtained from the reports of the Twelfth Census of the United States, and the Mortality Statistics of the registration states for the calendar year 1900. These registration

* Based on the returns from registration states of the Twelfth Census of the United States.

† George King, "On the Construction of Mortality Tables from Census Returns and Records of Deaths," *Journal of the Institute of Actuaries*, Vol. 42, p. 225.

‡ James W. Glover, "The Monetary Loss in the United States Due to Tuberculosis, Based on the Returns of the Twelfth Census of the United States," *Transactions of the Sixth International Congress on Tuberculosis*, Vol. 5, p. 55.

states were Connecticut, District of Columbia, Indiana, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. The records of the registration states are used because sufficiently complete and accurate data cannot be obtained for the other states. From the data at our disposal the statement appears to be conservative that the mortality in these states due to typhoid fever is no greater than that throughout the United States. Hence the results obtained on this basis apply to the population of the United States and may be applied in the same way to the population of any state or city where similar information is desired. If in the community in question the death-rate due to typhoid fever be less than the average for this area, these results may be proportionately reduced.

Two sets of life-tables were prepared on the basis of the statistics mentioned above. The first one takes into account deaths from all causes, and so represents the vital condition of the community as it was in 1900. The second table takes into account deaths from all causes except typhoid fever, and so represents the status as it would be in a population subject to all other conditions existing in 1900, but with no deaths from typhoid. The difference between these tables is a quantity which represents the loss due to typhoid mortality, and is the foundation for other computations intended to exhibit this loss from different points of view. The loss here shown is the total loss due to typhoid mortality in a given group living under such conditions that the death-rate due to typhoid is 31.3 per 100,000 of population, the average for the registration states in 1900.

To use these results to measure the minimum community loss due to impure water, we have only to show that this loss exceeds the loss from typhoid mortality in the group above mentioned. In making this comparison it should be first noted that only the cases of typhoid fever which terminate fatally affect the results given, whereas it is estimated by Whipple* that fifteen to eighteen cases occur for every death; it follows that the monetary loss due to morbidity in typhoid, though not considered here, must be extremely great.

* George Whipple, *The Value of Pure Water*, p. 8. New York, 1907.

Second, in finding the total loss to a community which may be prevented by sanitary measures, it should be remembered that the loss from other diseases which spring from the same causes is so great that the typhoid mortality represents less than half * of the total loss due to the conditions which produce typhoid fever.

Third, the loss shown in this paper is due only to deaths which are to occur among the present male population of the community who have attained age twenty, and does not include the losses which the community will sustain due to deaths among those who shall attain this age later.

It is well known that the amount of typhoid fever in a city or village is largely dependent upon the nature of the water supply. However, since there are other means of transmission of the disease, there may be some typhoid even when the water supply is perfect. That due to causes other than impure water is called residual typhoid. Where sanitary conditions are good, an annual death-rate of about 15 per 100,000 seems to represent fairly the residual typhoid, though this is often reduced to 10, and sometimes even less. When this is compared to death-rates of 60 and 100, which were the rates in some cities in 1907 and 1908, or even with the average rate in the total registration area of this country, which was 30.3 in 1907, it becomes apparent that the removable loss is over 15 per 100,000 for the registration area, and becomes in some cities as high as 45 to 85. We believe, in view of what has been stated, that the results finally derived in this paper may be considered minimum loss-rates based on a pure water supply. That is, we may conclude that a community, which with an impure water supply has a typhoid death-rate not less than that in the registration area, is losing through the existence of typhoid in excess of the possible residual an amount as great as that represented by the loss-rates to be given in this discussion.

Although the results show a great saving, the conservative character of the method again appears when the benefit of an improved water supply in various cities is considered. A few

* Whipple, *loc. cit.*, pp. 7–12.

examples may be cited. In the city of Camden, New Jersey,* in the years 1890 to 1899, with the population ranging from 58,313 in 1890 to 75,935 in 1900, there were 297 deaths due to typhoid fever, nearly 30 a year. In 1899 the water supply of the city was changed from the Delaware river to artesian wells. In the years 1900 to 1906 the total number of deaths from typhoid was 37—a little more than five per year,—with the population increasing to 92,458 in 1907.† In Albany, New York,‡ the death-rate per 100,000 due to typhoid fever in years 1894 to 1898 was 104; in years 1900 to 1904 it was 26. Filtered water was introduced into Albany in 1899. In Ithaca, New York,§ for several years prior to 1903 the average death-rate per 100,000 from the same cause was 67.2. Since that time, when filters were introduced, the rates for the years 1904 to 1908 have been 13.7, 6.8, 0, and 6.4, respectively.

When sanitary methods have become universal, the residual typhoid should be still further decreased, since the number of loci of infection will be made smaller.

Often in cities with a good water supply, hospitals receive cases of this disease contracted elsewhere, and the mortality is charged against the city in which the hospital is located, making the residual appear higher than it really is. Since, as has been pointed out, the results obtained in this paper are conservative, even though the residual typhoid cannot be eliminated from the community, it is apparent that any lowering of this residual would increase the monetary gain to the community to figures above those shown in this paper.

The results here obtained are based upon the fundamental figures shown in Table I which are drawn from the census reports.

* Report of Chief Engineer, Camden City Water Department, 1907.
† Police Census.
‡ Whipple, *The Value of Pure Water.*
§ *Bulletin* New York State Department of Health, April, 1908. April, 1909.

TABLE I.

POPULATION AND VITAL STATISTICS, REGISTRATION STATES, TWELFTH CENSUS.

Age Group.	Total Population June 1, 1900.	Deaths from All Causes, 1900.	Deaths from Typhoid Fever, 1900.	Deaths from All Causes Except Typhoid Fever, 1900.
Under 1	437,944	71,117	43	71,074
1- 2	394,138	16,866	52	16,814
2- 3	412,353	7,439	60	7,379
3- 4	416,695	4,691	67	4,624
4- 5	411,668	3,416	58	3,358
5- 9	1,984,846	9,242	347	8,895
10-14	1,819,115	5,423	569	4,854
15-19	1,804,950	8,746	746	8,000
20-24	1,905,779	13,013	890	12,123
25-29	1,839,826	14,533	854	13,679
30-34	1,630,050	13,991	637	13,354
35-39	1,474,697	14,331	479	13,852
40-44	1,247,880	13,736	393	13,343
45-49	1,013,403	13,416	301	13,115
50-54	872,741	14,886	216	14,670
55-59	685,469	16,101	159	15,942
60-64	562,777	17,988	124	17,864
65-69	414,450	19,568	95	19,473
70-74	288,229	20,154	64	20,090
75-79	176,031	18,477	40	18,437
80-84	87,093	14,053	20	14,033
85-89	31,558	7,418	5	7,413
90-94	7,989	2,622	1	2,621
95-99	1,576	802	0	802

The second column of Table I gives the total population of the registration states at the various ages indicated in the first column. After the fifth year, the ages are taken in groups of five. In the succeeding columns are shown the number of deaths occurring in each age group due to all causes and the number due to typhoid fever. For example, it appears that of the total population in these states on the date of the enumeration, there were 1,839,826 persons whose ages were over twenty-five and under thirty years; that during the calendar year 1900 among persons of these ages there had occurred 14,533 deaths from all causes; that 854 of these were due to typhoid fever, and 13,679 to other causes.

An understatement of deaths may be possible, but as our object is to exhibit the difference between two tables which depend upon the same returns, this understatement will affect our results only in so far as there is a difference in the percentage of understatement between the deaths due to typhoid fever and those due to other causes. The third column of Table II exhibits a mortality table with typhoid present. It was obtained by methods explained later in this paper from the second and third columns of Table I.

With typhoid mortality existing at various ages as exhibited in Table I, a group of 1,000,000 persons aged ten years will have such a life history as illustrated in the third column of Table II. Of this group there will remain living at age twenty, 959,714; at age fifty, 720,505; at age one hundred, 5. By using in the same way the data of the fifth column, Table I, we get the mortality table in the second column of Table II. It appears that the number living at each age beyond ten is greater than at the corresponding age in the former case.

In the fourth column, the difference between the two is tabulated. Thus at age twenty, there would be living 3,468 more people of the original group, if typhoid mortality were eliminated, than under existing conditions with typhoid present in the community. At age fifty-two this difference becomes 10,832, which is the maximum.

These mortality rates and the differences are shown in Table III in the more usual manner, in the form of death-rate per 1,000 per annum.

This death-rate is obtained from Table II by finding the ratio of the number dying in any year, d_x, where x denotes the age, to the number living at the beginning of the year, l_x, and multiplying this ratio by 1,000. The greatest losses are at the ages from fifteen to thirty-five. Evidently this disease rests most heavily upon those whose lives promise the greatest service and who have the greatest earning or wealth-producing power. This fact, however, will automatically carry its due weight into later results. The irregularity in the difference column at the ages two, three, and four, is due to a heavy infant typhoid mortality in one of the states. The

TABLE II.

MORTALITY TABLE WHEN TYPHOID MORTALITY IS NOT PRESENT, WHEN TYPHOID MORTALITY IS PRESENT, AND THE DIFFERENCE IN SURVIVORS AT EACH AGE. AGGREGATE POPULATION, REGISTRATION STATES.

Age.	Number Living when Typhoid Mortality		Loss in S'rviv'rs at Each Age.	Age.	Number Living when Typhoid Mortality		Loss in S'rviv'rs at Each Age.
	Is Not Present.	Is Present.			Is Not Present.	Is Present.	
0	1,302,659	1,304,688		50	731,303	720,505	10,798
1	1,107,118	1,108,732		51	720,376	709,553	10,823
2	1,060,874	1,062,281		52	708,993	698,161	10,832
3	1,042,059	1,043,288		53	697,115	686,291	10,824
4	1,030,559	1,031,608		54	684,711	673,914	10,797
5	1,022,187	1,023,083		55	671,762	661,009	10,753
6	1,016,962	1,017,725		56	658,257	647,566	10,691
7	1,012,147	1,012,754		57	644,179	633,569	10,610
8	1,007,734	1,008,164		58	629,512	619,001	10,511
9	1,003,700	1,003,928		59	614,238	603,846	10,392
10	1,000,000	1,000,000	0	60	598,343	588,089	10,254
11	996,574	996,321	253	61	581,811	571,713	10,098
12	993,349	992,816	533	62	564,629	554,708	9,921
13	990,239	989,402	837	63	546,791	537,064	9,727
14	987,147	985,984	1,163	64	528,278	518,767	9,511
15	983,972	982,460	1,512	65	509,060	499,784	9,276
16	980,601	978,723	1,878	66	489,104	480,085	9,019
17	976,923	974,662	2,261	67	468,394	459,655	8,739
18	972,822	970,167	2,655	68	446,925	438,488	8,437
19	968,236	965,177	3,059	69	424,729	416,618	8,111
20	963,182	959,714	3,468	70	401,891	394,127	7,764
21	957,728	953,846	3,882	71	378,523	371,128	7,395
22	951,937	947,640	4,297	72	354,745	347,738	7,007
23	945,879	941,166	4,713	73	330,691	324,089	6,602
24	939,612	934,486	5,126	74	306,485	300,301	6,184
25	933,172	927,638	5,534	75	282,232	276,480	5,752
26	926,580	920,647	5,933	76	258,046	252,735	5,311
27	919,862	913,542	6,320	77	234,064	229,199	4,865
28	913,049	906,355	6,694	78	210,437	206,021	4,416
29	906,159	899,107	7,052	79	187,369	183,399	3,970
30	899,191	891,799	7,392	80	165,114	161,581	3,533
31	892,136	884,424	7,712	81	143,923	140,814	3,109
32	884,982	876,970	8,012	82	123,986	121,282	2,704
33	877,715	869,426	8,289	83	105,509	103,185	2,324
34	870,325	861,781	8,544	84	88,588	86,617	1,971
35	862,811	854,032	8,779	85	73,253	71,607	1,646
36	855,177	846,181	8,996	86	59,500	58,152	1,348
37	847,421	838,225	9,196	87	47,426	46,343	1,083
38	839,539	830,156	9,383	88	37,072	36,220	852
39	831,527	821,970	9,557	89	28,326	27,672	654
40	823,381	813,661	9,720	90	21,023	20,537	486
41	815,096	805,223	9,873	91	15,011	14,664	347
42	806,666	796,647	10,019	92	10,216	9,980	236
43	798,082	787,925	10,157	93	6,562	6,410	152
44	789,325	779,039	10,286	94	3,930	3,839	91
45	780,367	769,961	10,406	95	2,159	2,109	50
46	771,174	760,658	10,516	96	1,063	1,039	24
47	761,708	751,096	10,612	97	453	442	11
48	751,932	741,241	10,691	98	157	154	3
49	741,809	731,056	10,753	99	40	39	1
				100	6	5	1

TABLE III.

COMPARATIVE TABLE SHOWING THE DEATH-RATE PER ANNUM PER 1,000 PERSONS FOR ALL AGES BETWEEN 0 AND 100; WHEN TYPHOID MORTALITY IS PRESENT, WHEN TYPHOID MORTALITY IS NOT PRESENT, AND THE DIFFERENCE. AGGREGATE POPULATION, REGISTRATION STATES.

Age.	Death-Rate Per Annum Per 1,000 When Typhoid Mortality		Difference.	Age.	Death-Rate Per Annum Per 1,000 When Typhoid Mortality		Difference.
	Is Present.	Is Not Present.			Is Present.	Is Not Present.	
0	150.194	150.109	.085	50	15.200	14.940	.260
1	41.896	41.770	.126	51	16.055	15.801	.254
2	17.879	17.735	.144	52	17.002	16.753	.249
3	11.195	11.036	.159	53	18.035	17.793	.242
4	8.264	8.124	.140	54	19.149	18.912	.237
5	5.237	5.112	.125	55	20.337	20.104	.233
6	4.884	4.735	.149	56	21.615	21.387	.228
7	4.532	4.360	.172	57	22.994	22.769	.225
8	4.202	4.003	.199	58	24.483	24.263	.220
9	3.913	3.686	.227	59	26.094	25.878	.216
10	3.679	3.426	.253	60	27.846	27.630	.216
11	3.518	3.236	.282	61	29.744	29.532	.212
12	3.439	3.131	.308	62	31.808	31.592	.216
13	3.455	3.122	.333	63	34.069	33.858	.211
14	3.574	3.216	.358	64	36.593	36.379	.214
15	3.804	3.426	.378	65	39.415	39.202	.213
16	4.149	3.751	.398	66	42.555	42.343	.212
17	4.612	4.198	.414	67	46.050	45.835	.215
18	5.143	4.714	429	68	49.876	49.664	.212
19	5.660	5.220	.440	69	53.985	53.771	.214
20	6.114	5.662	.452	70	58.354	58.145	.209
21	6.506	6.047	.459	71	63.024	62.818	.206
22	6.832	6.364	.468	72	68.008	67.806	.202
23	7.098	6.626	472	73	73.400	73.198	.202
24	7.328	6.854	.474	74	79.324	79.133	.191
25	7.536	7.064	.472	75	85.883	85.695	.188
26	7.717	7.250	.467	76	93.125	92.937	.188
27	7.867	7.407	.460	77	101.126	100.942	.184
28	7.997	7.546	.451	78	109.804	109.620	.184
29	8.128	7.690	.438	79	118.965	118.776	.189
30	8.270	7.846	.424	80	128.524	128.342	.182
31	8.428	8.019	.409	81	138.708	138.525	.183
32	8.602	8.211	.391	82	149.214	149.025	.189
33	8.793	8.420	.373	83	160.566	160.375	.191
34	8.992	8.634	.358	84	173.292	173.105	.187
35	9.193	8.848	.345	85	187.901	187.747	.154
36	9.402	9.069	.333	86	203.071	202.924	.147
37	9.626	9.301	.325	87	218.436	218.319	.117
38	9.861	9.543	.318	88	236.002	235.919	.083
39	10.109	9.796	.313	89	257.842	257.820	.022
40	10.370	10.062	.308	90	285.972	.....	....
41	10.650	10.342	.308	91	319.422	.....	....
42	10.948	10.641	.307	92	357.715	.....	....
43	11.278	10.973	.305	93	401.092	.....	....
44	11.653	11.349	.304	94	450.638	.....	....
45	12.082	11.780	.302	95	507.349	.....	....
46	12.571	12.275	.296	96	574.591	.....	....
47	13.121	12.834	.287	97	651.584	.....	....
48	13.740	13.463	.277	98	746.753	.....	....
49	14.433	14.164	.269	99	871.795	.....	....
				100	1,000.000		

TABLE IV.

COMPARATIVE TABLE SHOWING AGES 0 TO 100, THE TOTAL NUMBER OF YEARS OF FUTURE LIFETIME WHICH WILL BE LIVED BY THE SURVIVORS OF 1,000,000 PERSONS AT AGE 10, AND THE LOSS IN SAME DUE TO THE PRESENCE OF TYPHOID MORTALITY. AGGREGATE POPULATION, REGISTRATION STATES.

Age.	Total Future Lifetime in Years when Typhoid Mortality		Loss in Years.	Age.	Total Future Lifetime in Years when Typhoid Mortality		Loss in Years.
	Is Not Present.	Is Present.			Is Not Present.	Is Present.	
0	60,807,037	60,279,181	527,856	50	15,065,007	14,795,789	269,218
1	59,699,919	59,170,449	529,470	51	14,344,631	14,086,236	258,395
2	58,639,045	58,108,168	530,877	52	13,635,638	13,388,075	247,563
3	57,596,986	57,064,880	532,106	53	12,938,523	12,701,784	236,739
4	56,566,427	56,033,272	533,155	54	12,253,812	12,027,870	225,942
5	55,544,240	55,010,189	534,051	55	11,582,050	11,366,861	215,189
6	54,527,278	53,992,464	534,814	56	10,923,793	10,719,295	204,498
7	53,515,131	52,979,710	535,421	57	10,279,614	10,085,726	193,888
8	52,507,397	51,971,546	535,851	58	9,650,102	9,466,725	183,377
9	51,503,697	50,967,618	536,079	59	9,035,864	8,862,879	172,985
10	50,503,697	49,967,618	536,079	60	8,437,521	8,274,790	162,731
11	49,507,123	48,971,297	535,826	61	7,855,710	7,703,077	152,633
12	48,513,774	47,978,481	535,293	62	7,291,081	7,148,369	142,712
13	47,523,535	46,989,079	534,456	63	6,744,290	6,611,305	132,985
14	46,536,388	46,003,095	533,293	64	6,216,012	6,092,538	123,474
15	45,552,416	45,020,635	531,781	65	5,706,952	5,592,754	114,198
16	44,571,815	44,041,912	529,903	66	5,217,848	5,112,669	105,179
17	43,594,892	43,067,250	527,642	67	4,749,454	4,653,014	96,440
18	42,622,070	42,097,083	524,987	68	4,302,529	4,214,526	88,003
19	41,653,834	41,131,906	521,928	69	3,877,800	3,797,908	79,892
20	40,690,652	40,172,192	518,460	70	3,475,909	3,403,781	72,128
21	39,732,924	39,218,346	514,578	71	3,097,386	3,032,653	64,733
22	38,780,987	38,270,706	510,281	72	2,742,641	2,684,915	57,726
23	37,835,108	37,329,540	505,568	73	2,411,950	2,360,826	51,124
24	36,895,496	36,395,054	500,442	74	2,105,465	2,060,525	44,940
25	35,962,324	35,467,416	494,908	75	1,823,233	1,784,045	39,188
26	35,035,744	34,546,769	488,975	76	1,565,187	1,531,310	33,877
27	34,115,882	33,633,227	482,655	77	1,331,123	1,302,111	29,012
28	33,202,833	32,726,872	475,961	78	1,120,686	1,096,090	24,596
29	32,296,674	31,827,765	468,909	79	933,317	912,691	20,626
30	31,397,483	30,935,966	461,517	80	768,203	751,110	17,093
31	30,505,347	30,051,542	453,805	81	624,280	610,296	13,984
32	29,620,365	29,174,572	445,793	82	500,294	489,014	11,280
33	28,742,650	28,305,146	437,504	83	394,785	385,829	8,956
34	27,872,325	27,443,365	428,960	84	306,197	299,212	6,985
35	27,009,514	26,589,333	420,181	85	232,944	227,605	5,339
36	26,154,337	25,743,152	411,185	86	173,444	169,453	3,991
37	25,306,916	24,904,927	401,989	87	126,018	123,110	2,908
38	24,467,377	24,074,771	392,606	88	88,946	86,890	2,056
39	23,635,850	23,252,801	383,049	89	60,620	59,218	1,402
40	22,812,469	22,439,140	373,329	90	39,597	38,681	916
41	21,997,373	21,633,917	363,456	91	24,586	24,017	569
42	21,190,707	20,837,270	353,437	92	14,370	14,037	333
43	20,392,625	20,049,345	343,280	93	7,808	7,627	181
44	19,603,300	19,270,306	332,994	94	3,878	3,788	90
45	18,822,933	18,500,345	322,588	95	1,719	1,679	40
46	18,051,759	17,739,687	312,072	96	656	640	16
47	17,290,051	16,988,591	301,460	97	203	198	5
48	16,538,119	16,247,350	290,769	98	46	44	2
49	15,796,310	15,516,294	280,016	99	6	5	1
				100			

TABLE V.

COMPARATIVE TABLE SHOWING AT AGES 0 TO 100 THE COMPLETE EXPECTATION OF LIFE WHEN TYPHOID MORTALITY IS NOT PRESENT, WHEN PRESENT, AND THE LOSS IN DAYS DUE TO THE PRESENCE OF TYPHOID MORTALITY. AGGREGATE POPULATION, REGISTRATION STATES.

Age.	Complete Expectation of Life when Typhoid Mortality		Loss in Days.	Age.	Complete Expectation of Life when Typhoid Mortality		Loss in Days.
	Is Not Present.	Is Present.			Is Not Present.	Is Present.	
0	47.179	46.702	174	50	21.100	21.035	24
1	54.424	53.868	203	51	20.413	20.352	22
2	55.774	55.201	209	52	19.732	19.676	20
3	55.772	55.197	210	53	19.060	19.008	19
4	55.389	54.816	209	54	18.396	18.348	18
5	54.839	54.269	208	55	17.741	17.696	16
6	54.118	53.552	207	56	17.095	17.053	15
7	53.373	52.813	204	57	16.458	16.419	14
8	52.604	52.051	202	58	15.829	15.794	13
9	51.814	51.268	199	59	15.210	15.177	12
10	51.004	50.468	196	60	14.601	14.571	11
11	50.177	49.652	192	61	14.002	13.974	10
12	49.339	48.825	188	62	13.413	13.387	9
13	48.492	47.992	183	63	12.834	12.810	9
14	47.642	47.157	177	64	12.267	12.244	8
15	46.794	46.324	172	65	11.711	11.690	8
16	45.954	45.499	166	66	11.168	11.150	7
17	45.125	44.687	160	67	10.640	10.623	6
18	44.313	43.892	154	68	10.127	10.111	6
19	43.520	43.116	147	69	9.630	9.616	5
20	42.746	42.359	141	70	9.149	9.136	5
21	41.987	41.616	135	71	8.683	8.671	4
22	41.239	40.885	129	72	8.231	8.221	4
23	40.500	40.163	123	73	7.794	7.784	4
24	39.767	39.447	117	74	7.370	7.362	3
25	39.038	38.734	111	75	6.960	6.953	3
26	38.312	38.024	105	76	6.566	6.559	3
27	37.588	37.316	99	77	6.187	6.181	2
28	36.865	36.608	94	78	5.826	5.820	2
29	36.141	35.903	87	79	5.481	5.477	1
30	35.417	35.189	83	80	5.153	5.149	1
31	34.694	34.479	78	81	4.838	4.834	1
32	33.970	33.767	74	82	4.535	4.532	1
33	33.247	33.056	70	83	4.242	4.239	1
34	32.525	32.345	66	84	3.956	3.954	1
35	31.804	31.634	62	85	3.680	3.679	0
36	31.084	30.923	59	86	3.415	3.414	
37	30.363	30.212	55	87	3.157	3.156	
38	29.644	29.500	53	88	2.899	2.899	
39	28.925	28.789	50	89	2.640	2.640	
40	28.206	28.078	47	90	2.384	2.383	
41	27.487	27.367	44	91	2.138	2.138	
42	26.769	26.656	41	92	1.907	1.907	
43	26.052	25.946	39	93	1.690	1.690	
44	25.336	25.236	37	94	1.487	1.487	
45	24.621	24.528	34	95	1.296	1.296	
46	23.908	23.822	31	96	1.118	1.116	
47	23.199	23.118	30	97	.948	.948	
48	22.494	22.419	27	98	.793	.786	
49	21.794	21.724	26	99	.650	.628	

effect of typhoid fever on the community is made more apparent by an inspection of Table IV.

The third column of this table gives at each age for a community with typhoid fever present the total number of years of future lifetime remaining to the survivors of an original group of 1,000,000 persons at age ten. It is obtained by summing the numbers given in the third column of Table II from the bottom up to the age required. The second column, obtained from the second column of Table II, gives similar results for a community in which there are no deaths from typhoid fever, while the difference, given in the fourth column, shows the number of years of lifetime which would be gained were there no deaths from typhoid. For example, the group of persons who have attained the age of twenty years have 40,172,192 years yet to live. If typhoid were not present the years of future lifetime would be 40,690,652. Thus they have sustained a loss of 518,460 years from a preventable disease.

It should be remembered that the heaviest loss is at the younger ages and the elimination of typhoid mortality does not mean so much a lengthening of the period of old age, as a broadening of the active or wealth-producing period. This is revealed by the fact that of the 518,460 years of future lifetime, which are lost by the group who attain to the age of twenty years, 355,729 years are lost between ages twenty and sixty.

Possibly it is of greater interest to know the average future lifetime of the individuals of this group under the two conditions—typhoid present as now, and typhoid not present—together with the difference. This is exhibited in Table V, where it is seen that at the younger ages, the loss of future lifetime averages as much as half a year for each individual of the group. This average future lifetime is known as the complete expectation of life, and is obtained from the preceding table by dividing the total future lifetime at any age by the number living at that age, and adding to the quotient one half year. This one half year is the average length of life in the year in which death occurs, on the assumption that the deaths occur uniformly throughout the year.

We shall next consider the economic loss to the community,

brought about by this disease. Before proceeding to tables setting forth such values, let us notice the figures in Table IV. Between the ages twenty and seventy, the total number of years lost by the group of age twenty is approximately 450,000. If each one in this group during the years of his age from twenty to seventy has an annual wealth-producing capacity of $100, then the community sustains through this one group a loss of $45,000,000 due to typhoid mortality. This assumes nearly 960,000 people in the group at age twenty. According to the census of 1900 there were over 740,000 young men at age twenty in the United States. On a group of this size the loss is about $35,000,000. This loss is spread over fifty years and its present value is much less, but the illustration shows wherein the monetary loss to the community lies. The exact amounts of loss appear in the tables which follow.

On the basis of the mortality tables exhibited in Table II, corresponding sets of annuity tables were computed which appear in Table VI.

Table VI gives at the various ages up to sixty-nine, the value, capitalized at five per cent., of a life annuity of $100 per annum, payable at the end of each year until age seventy; stated in other words, the amount which, improved at five per cent. interest, would pay to the one at the given age, $100 each year of life up to the age of seventy. These values are found by well-known methods which need not be discussed here. To illustrate, if there were deposited in trust at five per cent. interest, for every person in this group whose age is twenty, $1,578.50, and if at the end of each year $100 were paid to all survivors, the fund would suffice to make the payments until age seventy and would then be exhausted. In the second column of Table VI we find that $1,587.71 is the amount required to make similar payments in a group where there are no deaths from typhoid fever. Or as appears in the fourth column, $9.21 more is required for each individual, since under these better conditions, people live longer, thus receiving additional payments from the fund. It is equally true that if the individual has a wealth-producing capacity of $100 per annum, the efforts of those at age twenty will yield to the community an average of $1,578.50 each, and

TABLE VI.

PRESENT OR CAPITALIZED VALUE AT EACH AGE FROM 0 TO 70 COMPUTED WITH 5 PER CENT. INTEREST, OF A WEALTH INCREMENT OR SAVING OF $100 PER ANNUM AT THE END OF EACH YEAR UNTIL AGE 70. BASED ON AGGREGATE POPULATION, REGISTRATION STATES.

Age.	When Typhoid Mortality		Loss in Value at Each Age.	Age.	When Typhoid Mortality		Loss in Value at Each Age.
	Is Not Present.	Is Present.			Is Not Present.	Is Present.	
0	$1,413.19	$1,406.79	$6.40	35	$1,388.33	$1,383.43	$4.90
1	1,645.93	1,638.19	7.74	36	1,370.76	1,366.08	4.68
2	1,703.56	1,695.32	8.24	37	1,352.48	1,348.00	4.48
3	1,721.03	1,712.49	8.54	38	1,333.43	1,329.16	4.27
4	1,727.25	1,718.47	8.78	39	1,313.59	1,309.51	4.08
5	1,728.47	1,719.43	9.04	40	1,292.92	1,289.03	3.89
6	1,724.21	1,714.91	9.30	41	1,271.36	1,267.66	3.70
7	1,719.04	1,709.49	9.55	42	1,248.88	1,245.37	3.51
8	1,712.89	1,703.14	9.75	43	1,225.43	1,222.12	3.31
9	1,705.77	1,695.84	9.93	44	1,200.98	1,197.86	3.12
10	1,697.68	1,687.63	10.05	45	1,175.50	1,172.58	2.92
11	1,688.70	1,678.55	10.15	46	1,148.99	1,146.27	2.72
12	1,678.89	1,668.70	10.19	47	1,121.43	1,118.91	2.52
13	1,668.37	1,658.18	10.19	48	1,092.81	1,090.47	2.34
14	1,657.27	1,647.13	10.14	49	1,063.11	1,060.95	2.16
15	1,645.75	1,635.69	10.06	50	1,032.31	1,030.31	2.00
16	1,633.98	1,624.03	9.95	51	1,000.36	998.52	1.84
17	1,622.14	1,612.34	9.80	52	967.24	965.56	1.68
18	1,610.42	1,600.80	9.62	53	932.91	931.37	1.54
19	1,598.95	1,589.53	9.42	54	897.30	895.90	1.40
20	1,587.71	1,578.50	9.21	55	860.33	859.06	1.27
21	1,576.59	1,567.63	8.96	56	821.88	820.74	1.14
22	1,565.49	1,556.79	8.70	57	781.83	780.81	1.02
23	1,554.29	1,545.87	8.42	58	740.05	739.15	.90
24	1,542.89	1,534.77	8.12	59	696.37	695.58	.79
25	1,531.22	1,523.40	7.82	60	650.62	649.93	.69
26	1,519.22	1,511.72	7.50	61	602.56	601.97	.59
27	1,506.83	1,499.65	7.18	62	551.94	551.45	.49
28	1,493.98	1,487.12	6.86	63	498.44	498.04	.40
29	1,480.60	1,474.06	6.54	64	441.71	441.39	.32
30	1,466.68	1,460.45	6.23	65	381.30	381.06	.24
31	1,452.19	1,446.26	5.93	66	316.70	316.53	.17
32	1,437.13	1,431.48	5.65	67	247.24	247.13	.11
33	1,421.48	1,416.09	5.39	68	172.07	172.02	05
34	1,405.22	1,400.09	5.13	69	90.12	90.10	.02

that this amount would be increased to $1,587.71 if the mortality from typhoid were eliminated. Thus in this one group is shown a loss caused by deaths from typhoid fever which averages $9.21 for every member of the group.

To find for any community the monetary loss due to this disease, the male population at each age is required. This number multiplied by the loss for that age as shown in the fourth column of Table VI, gives the loss on the basis of a

wealth-producing capacity of $100 per annum from the given age to age seventy. If the wealth-producing capacity is greater, the loss is greater in the same ratio. Such an application is made in Table VII for the male population of the United States in 1900.

TABLE VII.

TABLE SHOWING THE CAPITALIZED OR PRESENT VALUE, COMPOUNDED ANNUALLY, AT 5 PER CENT. OF THE LOSS DUE TO TYPHOID FEVER ON THE MALE POPULATION OF THE UNITED STATES FOR EACH AGE AND CERTAIN AGE GROUPS BETWEEN THE AGES 20 AND 60 ON THE BASIS OF A WEALTH-PRODUCING CAPACITY OF $100 PER ANNUM UNTIL AGE 70. BASED ON AGGREGATE POPULATION, REGISTRATION STATES.

Age.	Population, 1900.	Loss Rate.	Total Loss.	Age.	Population, 1900.	Loss Rate.	Total Loss.
20	743,687	9.21	$6,849,357.27	40	643,551	3.89	$ 2,503,413.39
21	739,047	8.96	6,621,861.12	41	393,935	3.70	1,457,559.50
22	745,491	8.70	6,485,771.70	42	451,803	3.51	1,585,828.53
23	721,847	8.42	6,077,951.74	43	390,257	3.31	1,291,750.67
24	734,301	8.12	5,962,524.12	44	389,226	3.12	1,214,385.12
20–24	3,684,373		31,997,465.95	20–44	14,799,693		92,911,492.23
25	745,136	7.82	5,826,963.52	45	476,468	2.92	1,391,286.56
26	673,529	7.50	5,051,467.50	46	349,745	2.72	951,306.40
27	666,166	7.18	4,783,071.88	47	337,687	2.52	850,971.24
28	684,941	6.86	4,698,695.26	48	349,707	2.34	818,314.38
29	599,305	6.54	3,919,454.70	49	331,628	2.16	716,316.48
20–29	6,963,450		56,277,118.81	20–49	16,644,928		97,639,687.29
30	777,266	6.23	4,842,367.18	50	454,433	2.00	908,866.00
31	502,398	5.93	2,979,220.14	51	276,208	1.84	508,222.72
32	579,386	5.65	3,273,530.90	52	310,129	1.68	521,016.72
33	543,950	5.39	2,931,890.50	53	264,837	1.54	407,848.98
34	528,037	5.13	2,708,829.81	54	263,666	1.40	369,132.40
20–34	9,894,487		73,012,957.34	20–54	18,214,201		100,354,774.11
35	608,152	4.90	2,979,944.80	55	297,606	1.27	377,959.62
36	492,186	4.68	2,303,430.48	56	244,362	1.14	278,572.68
37	475,287	4.48	2,129,285.76	57	207,971	1.02	212,130.42
38	551,768	4.27	2,356,049.36	58	202,677	.90	182,409.30
39	509,041	4.08	2,076,887.28	59	195,194	.79	154,203.26
				60	275,887	.69	190,362.03
20–39	12,530,921		84,858,555.02	20–60	19,637,898		101,750,411.42

The total loss, $101,750,411, seems very great, but it must be remembered that even in obtaining this figure, no account is taken of males younger than twenty or older than sixty, or of females; that in all these classes are large numbers of wealth-producing individuals; and further that the average wealth-producing capacity of those considered is several times $100 per annum. We also repeat that these computa-

tions are based upon the reports from registration states, where in many sections the mortality from typhoid has already been reduced to near the minimum residual, very greatly decreasing the average loss for the whole region.

The final sum, $101,750,411, which is the present value of the total loss may be reduced to annual loss by determining the annual payment on a fifty-year annuity whose present value at five per cent. is equal to the total loss. The resulting annual loss is $5,573,555. At the end of fifty years those now twenty will have attained to the age of seventy and an entirely new group will have appeared, hence the choice of fifty years as the basis for the computation of annual loss. The annual loss here determined is derived from the total loss sustained by a specified group, and no account is taken of persons below age twenty. We note, however, that in one year the whole group of those aged nineteen will have entered the age period with which we are dealing, and each succeeding year other groups enter, whose losses during the fifty years will swell the annual loss.

In Table VIII is exhibited the total and annual loss for the United States, based upon the population in 1900, also upon the population in 1910, as reported by the Census Bureau.

TABLE VIII.

MINIMUM ANNUAL AND TOTAL LOSSES FROM TYPHOID FEVER IN THE UNITED STATES CAPITALIZED AT 5 PER CENT.

Year.	*Population.	Capitalized Total Loss.	Capitalized Annual Loss.
1900	76,212,168	$101,750,411.42	$5,573,555.37
1910	92,228,531	123,133,762.24	6,744,865.51

* Continental United States, Alaska and Hawaii, U. S. Census.

It seems desirable to combine the results given in this paper into a formula for estimating the capitalized value of the removable loss from impure water for a community whose population and typhoid death-rate per 100,000 are known. The following formula is based upon the assumption already made, that the removable loss in a community due to impure water is equal to the total loss

due to typhoid mortality in the fixed group heretofore considered; and upon the further assumption that the total community loss due to impure water is proportional to the removable typhoid death-rate per 100,000. These assumptions while only approximately correct, may be considered, because of the conservative character of the original results, to give minimum losses for the area in question.

The formula for total loss is:

$$\text{Loss} = \frac{(t-r)}{31.3-15} \cdot \frac{101750411.42}{76212168} \cdot p.$$

In this formula t is the typhoid death-rate per 100,000 for the community, r is the estimated residual typhoid death-rate per 100,000, and p is the total population.

This formula simplifies to:

$$\text{Loss} = .0819\,(t-r)\,p.$$

The annual loss may be obtained by dividing the total loss by 18.256.

Table IX gives the total and annual community losses for certain cities as estimated by means of this formula, the typhoid residual r being assumed to be 15 per cent.

TABLE IX.

ESTIMATED TOTAL AND ANNUAL LOSSES DUE TO IMPURE WATER IN CERTAIN CITIES OF THE UNITED STATES CAPITALIZED AT 5 PER CENT.

City.	Population in 1910.	*Death Rate per 100,000	Estimated Present Value of the Total Loss.	Estimated Annual Loss.
Chicago, Ill.	2,185,283	25.3	$1,843,439.18	$100,977.58
Cincinnati, Ohio	363,591	50.7	1,063,078.27	58,231.96
Detroit, Mich.	465,766	20.9	225,062.79	12,328.20
Grand Rapids, Mich.	112,571	40.4	234,176.95	12,827.45
Indianapolis, Ind.	233,650	39.3	465,003.22	25,471.36
Minneapolis, Minn	301,408	34.9	491,237.77	26,908.40
Philadelphia, Pa.	1,549,008	53.6	4,896,940.95	268,238.44
Pittsburg, Pa.	533,905	116.9	4,455,762.91	244,072.15

* Engineering News, Vol. 63, No. 16, April 21, 1910, p. 453.

In calculating the total and annual capitalized losses the populations are those taken from the official reports of the last census, 1910, and the typhoid death-rate assumed is that given in *Engineering News* as the average rate for the period of years 1898–1908.

Finally we wish to call attention again to the fact that a wealth-producing capacity of $100 per annum for each individual is taken simply as a unit upon which to base the tables, that no assumption is made concerning the *actual* average wealth-producing capacity. The contention of this paper is that the results here given are conservative estimates upon the unit chosen. To find the actual losses these results should be multiplied by the average annual wealth-producing capacity per individual measured in units of $100. The determination of the latter quantity is an economic problem not considered here.

II.

The remainder of this paper is a description of the processes by which the life tables are computed. The formulæ used, with the exception of those dealing with the osculatory differences, for the derivation of which the reader is referred to King,* are well known formulæ of interpolation and no reference to their source of derivation need be given.

The figures in Table I are taken directly from the reports of the census, except that the number of deaths due to typhoid fever is given in those reports only in age groups of ten years each. To obtain the number at intervals of five years the following central difference formula of interpolation is used:

$$u_{0.5}=\frac{1}{2}(u_0+u_1)-\frac{1}{16}\delta^2(u_0+u_1)+\frac{3}{256}\delta^4(u_0+u_1).\dagger \qquad (1)$$

This formula enables us to make the interpolation for ages 25, 35.....75. To get the number at age eighty-five the ordinary difference formula is used in the form

$$u_{3.5}=u_0+3.5\,\Delta u_0+4.375\,\Delta^2 u_0+2.1875\,\Delta^3 u_0+ \qquad (2)$$
$$0.2734375\,\Delta^4 u_0$$

* *Loc. cit.*, p. 242.

† Bessel's formula: Given in a paper by James Buchanan: "Osculatory Interpolation by Central Differences, with an Application to Life Table Construction," *Journal of the Institute of Actuaries*, Vol. 42, p. 394.

with u_0 corresponding to age fifty. Again the same formula in the form

$$u_{2.5} = u_0 + 2.5\,\Delta u_0 + 1.875\,\Delta^2 u_0 + 0.3125\,\Delta^3 u_0 - 0.0390625\,\Delta^4 u_0, \qquad (3)$$

is used to obtain the number at age fifteen by reversing the table of differences and letting u_0 correspond to age forty. The number at age five is given in the census report.

The two mortality tables are constructed by the same methods, one based upon the numbers in the second and third columns of Table I, and the other upon the numbers in the second and fifth columns. They represent respectively the actual mortality and the mortality upon the supposition that no deaths occur due to typhoid fever. The following are the steps in the construction.

The sum of the numbers in the second column of Table I from the end of the column up to any given age is the total number living at that age and over, and is denoted by the symbol T_x. Thus T_{35} is 6,864,236. The number living at the given age x is found by subtracting the number living at age $x+1$ and over from the number living at age x and over. This is indicated by the symbol L_x, and we have $L_x = T_x - T_{x+1}$. We have T_x at the various five-year intervals $T_5, T_{10} \ldots\ldots T_{90}$. To get L_x at these ages we need T_6, $T_{11} \ldots\ldots T_{91}$. These are obtained by interpolation from the known values of T by employing the following central difference formula:

$$u_x = u_{-2} + (2+x)\,\Delta u_{-2} + \frac{(2+x)(1+x)}{2!}\,\Delta^2 u_{-2} + \frac{(2+x)(1+x)x}{3!}\,\Delta^3 u_{-2} + \frac{(2+x)(1+x)x(x-1)}{4!}\,\Delta^4 u_{-2}. \qquad (4)$$

Let $x = 0.2$ and let u_0 be successively $T_{15}, T_{20} \ldots\ldots T_{90}$, thus getting values of $T_{16}, T_{21} \ldots\ldots T_{91}$. By using the same formula adapted to two differences in the forms

$$u_x = u_{-1} + (1+x)\,\Delta u_{-1} + \frac{(1+x)x}{2!}\,\Delta^2 u_{-1} \qquad (5)$$

and

$$u_x = u_0 + x\,\Delta u_0 + \frac{x(x-1)}{2!}\,\Delta^2 u_0, \qquad (6)$$

we get T_{11} and T_6 thus:

$$T_{11}=T_5+1.2\,\Delta T_5+.12\,\Delta^2 T_5, \tag{7}$$

$$T_6=T_5+.2\,\Delta T_5-.08\,\Delta^2 T_5. \tag{8}$$

Then by subtraction we have directly the values of L_x for $x=5, 10\ldots\ldots 90$.

If we sum the third column of Table I from the bottom upward, we obtain for each age a quantity l_x which corresponds to the T_x obtained from the second column. The same methods and formulæ used above in getting T_{x+1} and L_x are employed here to find l_{x+1} and a new column d_x. The number l_x is the sum of all those who die at age x and above, hence l_x-l_{x+1} is the number who die in the year of life x and is denoted by the symbol d_x. Having for age x the number living l_x, and the number of deaths d_x, the probability of death in the year of life x, denoted by q_x, follows at once by applying the formula:

$$q_x=\frac{d_x}{L_x+0.5d_x}. \tag{9}$$

We have now a column q_x which represents the original data at the ages 5, 10, 15……85. The osculatory method is then employed to complete this table, that is, to find the values of q_x at the intervening ages. Let $\Delta, \Delta^2\ldots\ldots\Delta^5$ denote the quinquennial differences of the column q_x and let $\delta, \delta^2\ldots\ldots\delta^5$ denote the subdivided osculatory differences of q_x. The formulæ connecting quinquennial and subdivided osculatory differences are:

(*10*)

$$\delta u_{10}= .2\,\Delta u_0+.32\,\Delta^2 u_0+.088\,\Delta^3 u_0-.0176\,\Delta^4 u_0+.0016\,\Delta^5 u_0$$

$$\delta^2 u_{10}= .04\,\Delta^2 u_0+.048\,\Delta^3 u_0+.0016\,\Delta^4 u_0+.0048\,\Delta^5 u_0$$

$$\delta^3 u_{10}= .008\,\Delta^3 u_0+.0064\,\Delta^4 u_0-.0048\,\Delta^5 u^0$$

$$\delta^4 u_{10}= .0016\,\Delta^4 u_0-.0032\,\Delta^5 u_0$$

$$\delta^5 u_{10}= .008\,\Delta^5 u_0$$

These yield values of δ, δ^2, δ^3, δ^4, δ^5 at each of the ages 15, 20, 25……60 and the values of q_x at every age from fifteen to seventy-five follow at once. In deriving values

of q_x between the ages five and fifteen we reverse the table of δ's and using q_{15}, q_{16}, q_{17}, we find δq_{17} and $\delta^2 q_{17}$, then

$$\delta^3 q_{17} = {}_{1}{}_{9}{}^{1}{}_{2}{}_{5}(99q_{10} - 7q_5 - 92q_{17} - 609\delta q_{17}\delta - 1617\delta^2 q_{17}), \quad (11)$$

$$\delta^4 q_{17} = {}_{3}{}^{1}{}_{5}(q_{10} - q_{17} - 7\delta q_{17} - 21\delta^2 q_{17} - 35\delta^3 q_{17}). \quad (12)$$

Using $\delta^4 q_{17}$ as constant, q_{14}, q_{13}, etc., are obtained, reproducing correctly q_{10} and q_5. The census reports give numbers at each year of age for ages younger than five, so that q_0, q_1, q_2, q_3 and q_4 are at hand without interpolation.

It should be noted here that the values of q_x at ages younger than seventy-five represent the original data accurately at ages that are multiples of five, and that in forming the curve having as one axis, age, and for the other, probability of dying, the various interpolation curves are so joined that they have a common slope and radius of curvature at these points of junction.

The annuity values from which the financial loss due to typhoid fever is derived, being dependent only upon the value of q_x at ages younger than seventy, cannot be vitiated by what may appear to be arbitrary methods of graduation used at the higher ages. The data obtained from the census concerning ages of death beyond ninety were only sufficient to give us d_{85}. To obtain d_{90}, l_{91} is computed by applying the ordinary interpolation formula to the l_x column in the form

$$l_{91} = l_{85} + 1.2\,\Delta l_{85} + .12\,\Delta^2 l_{85}. \quad (13)$$

Having l_{91}, d_{90} and q_{90} follow directly. At this point the attempt was made to bring the table to an end by assuming q_{105} to be unity. After some experimenting and study of the data, it was decided to bring the table to an end at age 100. Consequently q_{100} is given the value unity. We have q_{90} and therefore $\Delta^3 q_{75}$. We use the ordinary fifth difference interpolation formula, assume the fifth difference to be zero, q_{100} to be unity, and solve for $\Delta^4 q_{75}$.

$$\Delta^4 q_{75} = \tfrac{1}{5}(q_{100} - q_{75} - 5\,\Delta q_{75} - 10\,\Delta^2 q_{75} - 10\,\Delta^3 q_{75}). \quad (14)$$

Using this fourth difference, we derive at once a value of

q_{95}. The corresponding subdivided osculatory differences are computed and q_{76}, $q_{77}\ldots\ldots q_{80}$ are produced. To get q_{81}, $q_{82}\ldots\ldots q_{90}$ the formulæ for subdivided osculatory third differences apply. They are:

$$\begin{aligned}\delta\, u_5 &= .2\,\Delta u_0 + .12\,\Delta^2 u_0 - .016\,\Delta^3 u_0 \\ \delta^2 u_5 &= .04\,\Delta^2 u_0 - .016\,\Delta^3 u_0 \\ \delta^3 u_5 &= .024\,\Delta^3 u_0\end{aligned} \qquad (15)$$

The values of q_x from age ninety to age one hundred are obtained by the same method as that employed at the ages between five and fifteen, finding $\delta^3 q_{88}$ and $\delta^4 q_{88}$. The table q_x having been completed, the life-table l_x is built upon a radix of one million at age ten, the equation $l_{x+1} = l_x - l_x.q_x$ being used as well adapted to a continuous process on a computing machine. The numbers in the l_x column are made integral, the d_x column derived from them and a new q_x formed from l_x and d_x in the usual manner. The l_x column is the one exhibited in Table II. From the l_x and d_x columns the various commutation columns are constructed and the values of the temporary life annuities immediate, last payment at age seventy, set forth in Table VI, are derived by means of the formula:

$$a_{x:\overline{70-x}|} = \frac{N_x - N_{70}}{D_x}. \qquad (16)$$

TABLE XIII.

Commutation Columns, Typhoid Mortality Included, 5 per cent.

X	D.	N.	M.
0	1304688.000	19740945.249	364642.986
1	1055935.235	18436257.249	178018.225
2	963520.1830	17380322.014	135885.798
3	901231.4020	16416801.831	119478.931
4	848706.4497	15515570.429	109869.766
5	801612.3046	14666863.979	103190.205
6	759442.0680	13865251.675	99191.9833
7	719745.3597	13105809.607	95659.1804
8	682365.0765	12386064.247	92552.4938
9	647140.9438	11703699.170	89821.9304
10	613913.2500	11056558.226	87410.4792
11	582528.2549	10442644.976	85259.4440
12	552837.1000	9860116.7216	83307.7889
13	524701.0043	9307279.6216	81497.2118
14	497988.9176	8782578.6173	79770.8895
15	472580.0601	8284589.6997	78075.7853
16	448364.2812	7812009.6396	76363.8225
17	425241.8045	7363645.3584	74592.0217
18	403124.4224	6938403.5540	72724.2564
19	381953.3163	6535279.1315	70749.5439
20	361706.1104	6153325.8152	68690.5967
21	342375.7343	5791619.7048	66584.3229
22	323950.6108	5449243.9705	64462.8026
23	306416.6475	5125293.3597	62355.0539
24	289754.1209	4818876.7121	60283.8003
25	273934.0710	4529122.5912	58261.5669
26	258923.4444	4255188.5202	56295.4130
27	244690.6899	3996265.0859	54392.3507
28	231205.3961	3751574.3959	52558.9927
29	218434.7369	3520368.9998	50798.1178
30	206342.1785	3301934.2629	49107.2114
31	194891.2039	3095592.0844	47482.0603
32	184046.3351	2900700.8805	45917.7178
33	173774.3830	2716654.5454	44409.8794
34	164044.1499	2542880.1624	42954.6169
35	154827.7089	2378836.0125	41549.7985
36	146099.4199	2224008.3036	40194.2652
37	137834.0560	2077908.8837	38886.0153
38	130006.8792	1940074.8277	37622.3666
39	122595.1569	1810067.9485	36401.4414
40	115577.0300	1687472.7916	35221.1838
41	108931.8558	1571895.7616	34079.6777
42	102639.6968	1462963.9058	32974.7491
43	96681.86437	1360324.2090	31904.5213
44	91039.53386	1263642.3446	30866.0915
45	85693.97214	1172602.8110	29855.7418
46	80627.22262	1086908.8389	28869.6547
47	75822.54783	1006281.6162	27904.3783
48	71264.47376	930459.06840	26956.8979
49	66938.34579	859194.59464	26024.3194

50	62830.72348	792256.24885	25104.2329
51	58929.20683	729425.52537	24194.6565
52	55221.98681	670496.31854	23293.5908
53	51698.20495	615274.33173	22399.4254
54	48348.42341	563576.12678	21511.4658
55	45164.36534	515227.70338	20629.7136
56	42138.90690	470063.33804	19754.9405
57	39264.84322	427924.43114	18887.4895
58	36535.24031	388659.58792	18027.6438
59	33943.57251	352124.34760	17175.7464
60	31483.65042	318180.77510	16332.1872
61	29149.47908	286697.12468	15497.2370
62	26935.67748	257547.64560	14671.5031
63	24837.06174	230611.96812	13855.5387
64	22848.47518	205774.90638	13049.6691
65	20964.17956	182926.43120	12253.3991
66	19178.93007	161962.25164	11466.4431
67	17488.35589	142783.32157	10689.1491
68	15888.59076	125294.96568	9922.16387
69	14377.27054	109416.37492	9167.44154
70	12953.44498	95029.104386	8428.24851
71	11616.71835	82075.659402	7708.35428
72	10366.27147	70458.941050	7011.08481
73	9201.220522	60092.669582	6339.66535
74	8119.862763	50891.449060	5696.45971
75	7119.774720	42771.586297	5083.03323
76	6198.386531	35651.811577	4500.68141
77	5353.485847	29453.425046	3950.94235
78	4582.961868	24099.939199	3435.34495
79	3885.458202	19516.977332	2956.07933
80	3260.216605	15631.519130	2515.85798
81	2705.905762	12371.302524	2116.79578
82	2219.595223	9665.3967617	1759.33850
83	1798.476372	7445.8015387	1443.91449
84	1437.811884	5647.3251672	1168.89149
85	1132.048668	4209.5132831	931.595544
86	875.5580282	3077.4646148	729.012086
87	664.5308142	2201.9065866	559.678111
88	494.6409654	1537.3757724	421.432653
89	359.9092267	1042.7348070	310.255143
90	254.3899707	682.82558023	221.874540
91	172.9920878	428.43560956	152.590406
92	112.1282940	255.44352172	99.9642613
93	68.58879480	143.31522772	61.7642617
94	39.12225086	74.72643292	35.5638691
95	20.46883623	35.60418206	18.7734060
96	9.60379909	15.13534583	8.88306431
97	3.89099230	5.53154674	3.62758376
98	1.29112830	1.64055444	1.21300616
99	.31140369	.34942614	.29476451
100	.03802245	.03802245	.03621185

TABLE XIV.

Commutation Column, Typhoid Motality Excluded, 5 per cent.

X	D.	N.	M.
0	1302659.000	19795487.065	360016.757
1	1054398.093	1849282.8065	17378.234
2	962243.9926	17438429.972	131842.562
3	900169.7456	16476185.980	115589.458
4	847843.4348	15576016.234	106128.379
5	800910.2651	14728172.799	99568.6984
6	758872.7056	13927262.534	95669.7229
7	719313.9761	13168389.829	92247.7923
8	682074.0356	12449075.852	89260.9002
9	646993.9730	11767001.817	86660.5478
10	613913.2500	11120007.844	84389.0688
11	582676.1788	10506094.594	82385.9575
12	553133.8943	9923418.4151	80590.1569
13	525144.8833	9370284.5207	78940.8575
14	498576.3116	8845139.6374	77379.1874
15	473307.3579	8346563.3258	75851.9581
16	449224.6146	7873255.9679	74307.6641
17	426228.2713	7424031.3532	72702.9649
18	404227.6298	6997803.0820	70998.9147
19	383163.8665	6593575.4522	69184.0788
20	363013.1631	6210411.5857	67279.2794
21	343769.1486	5847398.4226	65321.6077
22	325419.5397	5503629.2740	63341.9551
23	307951.0651	5178209.7343	61369.6441
24	291343.5291	4870258.6692	59426.4485
25	275568.2765	4578915.1401	57524.6987
26	260592.0356	4303346.8636	55670.7598
27	246383.4913	4042754.8280	53871.3548
28	232912.9929	3796371.3367	52133.4018
29	220147.9944	3563458.3438	50459.5017
30	208052.5206	3343310.3494	48847.2636
31	196590.6161	3135257.8288	47292.6276
32	185727.7829	2938667.2126	45791.2450
33	175431.1264	2752939.4298	44338.7712
34	165670.5413	2577508.3033	42932.0493
35	156419.2564	2411837.7620	41569.8340
36	147652.6459	2255418.5056	40251.7673
37	139346.2060	2107765.8597	38976.4046
38	131476.3073	1968419.6537	37742.0412
39	124020.5641	1836943.3464	36547.0676
40	116957.7140	1712922.7823	35389.9635
41	110267.4910	1595965.0683	34269.1554
42	103930.5409	1485697.5772	33183.0375
43	97928.17296	1381767.0363	32129.7429
44	92241.56930	1283838.8634	31106.3882
45	86852.12362	1191597.2941	30109.3941
46	81741.88370	1104745.1705	29134.9666
47	76893.82085	1023003.2868	28179.3814
48	72292.32906	946109.46590	27239.4961
49	67922.93251	873817.13685	26312.3947

50	63772.34936	805894.20433	25396.4323
51	59828.06964	742121.85497	24488.9321
52	56078.75848	682293.78533	23588.5784
53	52513.57535	626215.02686	22693.8103
54	49123.02955	573701.45151	21803.9136
55	45899.07912	524578.42195	20919.1550
56	42834.59978	478679.34283	20040.3474
57	39922.38800	435844.74306	19167.8766
58	37155.63012	395922.35506	18302.1876
59	34527.73073	358766.72494	17443.6009
60	32032.60364	324238.99421	16692.6538
61	29664.33783	292206.39057	15749.7498
62	27417.42437	262542.05274	14915.4211
63	25286.89659	235124.62837	14090.4849
64	23267.37586	209837.73178	13275.1019
65	21353.27511	186570.35593	12468.9744
66	19539.23037	165217.08082	11671.7516
67	17820.84600	145677.85045	10883.8044
68	16194.30503	127857.00445	10105.8763
69	14657.17698	111662.69942	9339.90388
70	13208.61793	97005.522488	8589.30629
71	11848.19006	83796.904561	7857.86195
72	10575.15420	71948.714500	7149.02598
73	9388.658102	61373.560298	6466.10814
74	8287.072434	51984.902196	5811.60017
75	7267.897348	43697.829763	5187.04904
76	6328.640081	36429.932415	4593.88159
77	5467.119452	30101.292334	4033.72514
78	4681.196317	24634.172882	3508.13969
79	3969.565908	19952.976564	3019.42519
80	3331.501876	15983.410657	2570.38650
81	2765.648835	12651.908781	2163.17664
82	2269.081424	9886.2599463	1798.30741
83	1838.982832	7617.1785218	1476.26014
84	1470.529794	5778.1956901	1195.37746
85	1158.070595	4307.6658959	952.943534
86	895.8540150	3149.5953009	745.873278
87	680.0603544	2253.7412859	572.739362
88	506.2763630	1573.6809015	431.339236
89	368.4153208	1067.4045384	317.586487
90	260.4100089	698.98921765	227.124883
91	177.0856677	438.57920872	156.200958
92	114.7798248	261.49354106	102.327695
93	70.21523736	146.71371626	63.2288715
94	40.04960820	76.49847890	36.4068438
95	20.95410973	36.44887070	19.2184564
96	9.82563853	15.49476097	9.08778885
97	3.98782695	5.66912244	3.71786715
98	1.31628015	1.68129549	1.23621795
99	.31938840	.36501534	.30200688
100	.04562694	.04562694	.04345422

MOVEMENT OF WHOLESALE PRICES IN NEW YORK CITY, 1825–1863.

By Carl H. Juergens.*

The price quotations upon which this study is based were secured from the Report of the Secretary of the Treasury on the state of the finances for the year ending June 30, 1863† This report furnishes maximum and minimum prices at the beginning of each month for about eighty-seven articles. A few of these articles, like clover and timothy seed, were omitted because they did not seem suitable for inclusion in a consumer's index number, and a few others could not be used because the same quality or grade was not quoted throughout the entire period. Yearly quotations for seventy-four articles, however, were found to be serviceable and the following statistics are based upon these articles. The maximum and minimum monthly prices of each article were averaged in the first place, and from these monthly averages an average yearly price was computed. The results of this computation appear in Table I. Then, in the second place, using the average prices of 1860 as a base or datum line, relative prices or index numbers were computed for each year covered in the investigation. The average of these seventy-four relative prices furnishes in each year the simple index number. The relative prices and index numbers appear in Table II, and a curve of the index numbers is found in Graph I.

Table III and Graph II represent an attempt to produce a weighted index number. The weights employed and other details of the computation are shown in the table. The writer recognizes that the weights represent little more than careful guesses, and on the whole is not inclined to place much confidence in this section of the paper. Inasmuch, however, as the work of weighting was performed the results

* In the preparation of the charts and tables, valuable assistance was received from Mr. H. H. Siefert.

† Statement No. 27, p. 283–401.

TABLE I: YEARLY AVERAGE PRICES — 74 COMMODITIES — NEW YORK MARKET — 1825–1863.

were thought to deserve at least passing discussion. Those readers familiar with the subject of weighting will understand that errors in weights are usually of comparatively little importance, and that it is helpful to subject ordinary arithmetical averages to weighting, even though one is forced to depend largely upon inference and upon his imagination for the actual weights that are used.*

It should be noted, moreover, in this connection that the simple index number itself contains a natural system of weighting, due to the inclusion of a larger number of varieties or grades in the case of the important articles than in the case of the unimportant articles. Thus, the food group contains 36 out of the 74 commodities, or 48.6 per cent. This natural system of weighting in the simple index number, combined with the uncertainty of the weights employed in the weighted index number, make it probable that the simple index number represents the price movement between 1825 and 1863 just as correctly, if not more correctly, than the weighted index number.

The period here under discussion was marked by rapid economic changes—perhaps the most rapid that the United States has ever seen—and all of these exercised an influence, direct or indirect, on the movement of prices. The simple index number as projected in Graph I shows a steady fall in the price level terminating in the year 1848, although this fall is interrupted by a striking period of inflation lasting from 1834 to 1836, during which the curve ascends very abruptly from an index of 100 to one of 123.

Then occurs the great fall in prices incident to the panic of 1837. Over the seven years 1836 to 1843 the drop in the price level is 34 per cent. These years of leanness are succeeded by gradual recovery until 1847. There within a year the index drops 14.5 points, touching 87.7 in 1848, the lowest point reached during the entire period. After 1848 a steady rise in values is seen, till in 1857 the maximum crest of this wave records a level of 120.3. This is, next to the index of 1836, the highest point attained in the period, if the unnatural upward distortion of the curve after 1860 is dis-

* See Bowley, Elements of Statistics, p. 205.

regarded. The year 1858 shows a tremendous fall in prices, resulting in an index number of only 99.5 in 1858 as contrasted with 120.3 in 1857, and it is not until 1862 that the price curve under the influence of war conditions, returns to the general level which characterized the years preceding 1858. The reasons for the sharp and abnormal rise after 1860 are too well known to call for comment.

Certain other characteristics of the price movement before 1860, however, deserve more extended discussion.

The first gradual sinking of prices from 1825 to 1830 is due to several causes. One of these was undoubtedly the feeling of insecurity which prevailed in eastern markets, where conservative business men were distrustful of the erratic administration of Jackson.* But that this was not the sole reason is evidenced by the continued fall of the curve. Other and deeper forces were at work. The need of currency which the West experienced, the Tariff of Abominations,† and the better than average crops in the opening years of the period‡ must bear the balance of responsibility for this fall in prices. This early tendency for the price curve to fall is in 1830–31 arrested by a rise of 4 per cent. But this short rise is compensated by an accelerated fall of 13 per cent. from 1832 to 1834.

The ascent of 23 per cent. from 1834 to 1836 sets off in strong contrast the slow fall just noted. High prices prevailed thereafter until well into the year 1840. Among the causes for this phenomenon an important place must be given to the abolition of the Second National Bank and the substitution of "wild cat" for conservative banking. The era of speculation which followed the apportionment among the several states of the proceeds of the land sales was largely, as is well known, a consequence of the issuance of paper money by the state banks. Prices went soaring until they reached a maximum in 1836. In that year the prices in New York of prime beef went as high as $8.75 per barrel. Mess pork sold at $30.00 per barrel, ham at 17 cents a pound, sugars at 12 to

* McMaster, History of the United States, Vol. V., pp. 121–123, 227–267; J. L. Bishop, American Manufactures, Vol. II., p. 342, ff.

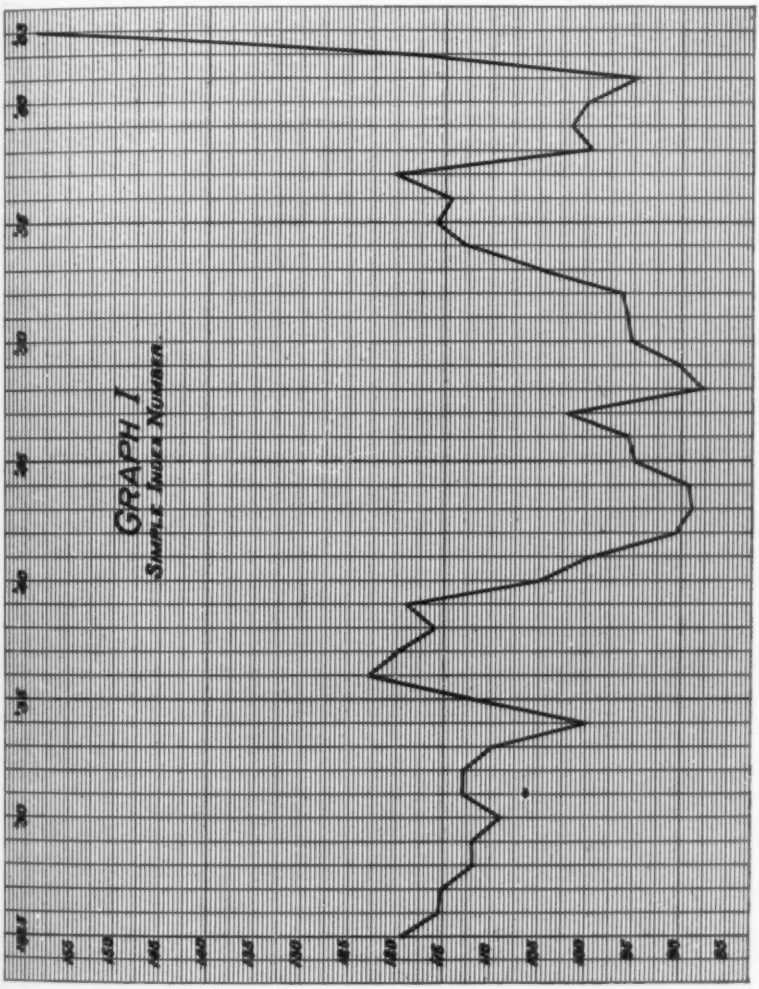
† Bolles, Financial History of the United States, p. 375 ff.

‡ Benton, Thirty Years' View.

TABLE II: SIMPLE INDEX NUMBER of YEARLY AVERAGE PRICES — NEW YORK MARKET — 1825–1863. (BASE: 1860).

	1825	1826	1827	1828	1829	1830	1831	1832	1833	1834	1835	1836	1837	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863
1 Beef, Prime	140	119	151	156	172	143	134	135	138	142	185	132	201	267	264	212	136	88	118	148	160	146	148	140	143	128	148	165	212	146	235	170	146	160	142	100	142	160	154.9
2 " Mess	170	177	174	176	178	174	184	183	181	178	214	214	267	284	286	231	134	146	148	148	160	146	241	241	226	135	131	207	137	210	230	182	232	206	142	100	110	151	138	148.3
3 Pork, Prime	85	65	71	82	81	80	81	82	90	81	104	143	110	143	138	105	110	76	82	82	82	80	76	82	70	76	71	85	130	98	140	137	136	140	107	100	90	90	82	83.3
4 " Mess	78	64	75	75	70	74	75	78	81	77	82	169	118	118	103	83	81	87	85	92	76	80	81	92	89	98	78	96	98	97	90	100	91	95	92	100	100	100	100	100.0
5 Smoked Ham	66	88	76	68	68	71	79	89	87	89	92	81	90	82	84	84	—	—	—	—	—	—	—	—	—	88	71	71	91	100	100	100	100	100	100	100	—	—	—	90.9
6 Lard	79	78	82	84	86	72	81	82	82	71	84	136	93	100	109	81	84	86	86	86	86	87	85	84	86	84	73	81	100	81	100	100	127	81	100	100	92	95	90	92.6
7 Fish, Dry Cod	85	89	78	78	88	81	79	76	71	68	93	88	90	90	110	86	87	89	86	90	79	86	90	89	88	90	87	90	100	100	100	100	100	100	100	100	100	100	100	100.0
8 " Mackerel #1	32	31	32	32	33	35	38	34	40	37	43	59	58	60	81	79	78	83	85	85	78	84	80	81	84	85	89	80	81	80	146	112	78	85	100	100	100	100	100	100.0
9 Butter, West'n Dairy	85	93	102	85	84	83	81	81	85	86	105	107	109	121	115	108	92	91	88	81	81	78	87	87	91	81	79	105	108	115	131	115	130	108	100	100	100	100	100	100.0
10 Cheese, American	75	79	75	69	69	70	69	69	68	69	75	89	81	79	81	72	67	68	69	68	69	79	91	99	82	83	81	71	82	88	87	80	85	86	100	100	100	100	100	100.0
11 Wheat Genesee	61	63	66	61	63	72	80	84	80	72	86	119	118	128	115	80	75	86	85	79	78	86	96	96	79	96	98	108	119	120	130	108	96	92	100	100	100	100	100	100.0
12 Wheat Flour, Superfine	100	84	100	108	125	87	111	112	108	87	110	146	138	125	142	143	108	117	86	88	86	80	100	110	108	107	80	97	110	120	130	104	108	84	90	100	87	90	111	111.2
13 Rye, Northern	85	86	82	85	80	79	85	101	89	80	110	136	135	126	110	78	77	79	75	86	84	80	120	80	73	78	89	87	112	146	132	116	103	86	103	100	91	88	100	91.2
14 Rye Flour, Fine	79	100	96	91	103	95	108	121	107	118	120	158	182	141	132	86	91	86	87	86	91	88	131	107	86	91	85	98	133	140	160	116	112	98	100	100	88	86	121	101.4
15 Corn, Northern	75	102	82	82	78	78	95	89	90	89	122	122	130	111	116	79	78	81	79	87	78	89	110	87	84	82	89	96	115	135	86	110	100	100	100	100	100	100	100	100.0
16 Corn Meal, Northern	78	107	80	78	77	73	101	96	107	87	118	132	127	108	113	90	87	83	77	79	76	104	117	80	82	83	86	86	106	130	99	101	101	100	100	100	100	100	100	100.0
17 Oats, Northern	77	114	87	72	88	74	90	112	98	86	117	126	126	95	114	82	105	118	110	77	81	84	118	100	90	104	100	108	113	100	103	98	105	100	100	100	100	100	100	100.0
18 Rice	72	73	60	77	73	65	76	82	78	71	85	90	98	107	107	92	89	95	89	85	79	83	89	101	97	90	78	94	91	96	107	113	104	96	80	100	100	100	100	100.0
19 Hops	137	127	101	91	87	88	93	139	206	116	116	116	58	58	121	303	187	87	76	67	115	159	96	98	68	107	286	286	196	237	146	60	62	50	80	100	100	100	100	100.0
20 Coffee, Rio #7	122	107	100	82	86	79	82	89	80	79	89	89	79	74	79	81	74	53	68	80	82	82	82	94	71	79	69	86	84	79	79	80	82	73	90	100	83	78	122	93.6
21 " Java	123	105	100	84	81	82	77	80	80	75	75	84	84	75	75	78	78	66	69	63	57	58	50	64	59	78	69	72	86	86	89	87	100	84	100	100	100	100	170	89.4
22 Tea, Young Hyson	165	153	161	156	154	147	184	183	125	102	105	108	103	87	106	113	125	107	100	101	100	97	91	85	93	98	85	86	78	71	81	68	91	80	100	100	100	83	100	100.0
23 " Souchong	204	181	218	206	200	194	207	183	117	87	80	104	102	90	90	149	142	160	140	132	119	117	102	87	113	132	110	99	80	76	70	69	83	80	100	100	97	93	100	100.0
24 " Imperial	408	378	397	364	360	352	372	348	228	243	247	250	247	238	238	234	—	200	184	181	203	183	171	150	157	177	174	164	138	138	129	79	78	101	80	100	100	145	231	184	240.1
25 Molasses, New Orleans	73	71	75	70	64	63	61	64	68	62	67	82	70	79	74	56	58	64	49	63	60	62	74	60	55	59	65	62	61	63	68	100	100	83	87	100	100	92	105	74.7
26 " Sugar House	150	162	181	137	137	121	100	112	111	86	107	140	132	133	114	89	82	86	71	96	80	82	86	79	66	86	86	96	79	73	86	105	145	104	83	86	100	90	100	102.6
27 " Nassau	127	118	132	127	110	103	108	114	114	103	117	127	127	135	127	96	86	88	83	100	102	82	96	82	87	82	87	91	85	88	100	100	100	81	100	100	100	100	100	100.0
28 Sugar, New Orleans	118	118	112	111	101	114	85	82	96	96	102	127	97	99	100	85	90	87	79	90	86	89	96	89	88	96	96	97	88	90	89	119	100	96	87	100	100	100	100	100.0
29 " Muscovado	138	116	138	132	118	113	86	91	100	102	110	129	96	107	107	89	86	91	90	96	96	104	96	92	90	94	94	94	90	88	100	100	100	96	115	102	100	100	100	100.0
30 " Loaf	182	183	183	183	183	183	183	183	182	181	183	184	183	183	182	127	132	100	110	113	117	113	103	83	86	90	91	94	88	91	88	100	100	100	100	100	100	100	100	100.0
31 Salt, Liverpool	230	254	246	230	254	219	211	220	230	235	230	218	206	198	173	146	140	134	146	151	140	138	140	159	142	151	149	138	140	125	114	102	88	94	100	100	100	100	100	100.0
32 " Turk's Island	273	268	300	263	255	247	268	258	231	203	169	200	208	211	200	179	168	—	147	—	145	138	140	132	126	124	119	113	101	207	231	158	116	89	87	100	115	153	211	154.3
33 Pepper	258	257	294	239	183	183	183	214	143	96	101	110	99	99	130	97	98	100	110	137	136	134	87	76	86	96	130	143	157	144	157	162	152	110	119	100	128	209	306	140.1
34 Raisins, Muscatel	143	130	98	109	119	99	99	109	99	85	82	108	93	85	85	83	84	74	84	90	90	90	89	69	79	102	81	84	110	109	155	103	91	84	100	100	100	100	100	100.0
35 " Malaga	403	344	324	310	331	331	347	340	296	284	328	300	292	263	240	202	164	181	202	235	234	231	202	212	210	228	234	206	243	252	221	200	120	155	112	100	108	103	88	205.5
36 Nutmeg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
37 Olive Oil	75	68	77	69	63	76	76	77	82	74	83	89	76	88	84	86	104	94	87	79	78	70	89	84	79	94	89	89	85	89	101	89	89	100	91	100	100	100	100	100.0
38 Wool, Common	91	80	66	67	69	60	75	75	88	86	82	115	119	83	103	76	78	67	55	60	79	85	74	71	79	88	87	87	118	88	90	86	100	84	100	100	100	100	100	100.0
39 " Fleece	110	87	74	80	83	83	81	142	134	153	155	132	139	115	141	94	108	87	99	106	101	78	97	82	87	108	116	100	133	101	83	103	91	89	105	100	89	137	135	111.8
40 " Merino	57	88	78	76	69	77	108	84	89	98	110	117	114	77	102	78	89	64	61	60	70	65	74	83	92	81	86	80	100	84	95	80	86	78	86	100	86	106	150	88.
41 Cotton, Upland	164	110	95	95	85	91	85	95	149	118	167	135	109	100	110	80	93	96	62	62	59	64	91	95	76	117	101	88	100	85	82	100	138	100	100	100	100	100	100	100.0
42 Sheeting, Russia White	—	142	115	145	106	113	112	111	105	87	87	112	118	115	118	109	102	107	104	102	86	95	87	90	100	100	100	100	100	—	—	—	—	—	—	—	—	—	—	100.0
43 " Russia Brown	—	108	103	99	105	111	108	103	97	96	97	103	112	108	108	89	87	88	85	98	98	104	102	101	100	104	101	88	87	88	—	—	—	—	—	—	—	—	—	92.6
44 Hides, West Indies	65	59	52	58	53	52	68	55	52	47	58	52	48	61	58	53	—	58	—	52	57	47	50	52	60	51	55	59	74	70	85	106	108	98	109	100	100	117	84.8
45 " La Plata	75	70	68	69	83	68	67	61	58	53	59	56	58	69	69	61	60	62	59	51	49	48	49	52	56	58	72	59	96	112	137	102	110	100	89	100	100	110	100	74.5
46 Lead, Pig, Domestic Soft	109	89	85	89	89	93	102	96	88	79	80	87	92	85	104	87	97	86	76	76	69	80	79	85	79	79	89	76	89	103	106	108	136	116	119	100	93	109	127	92.6
47 Pig, Spanish	450	450	443	533	639	580	435	424	388	396	410	435	409	409	409	360	232	217	218	232	218	231	245	245	206	206	205	205	182	183	119	180	183	183	116	100	100	134	212	209.9
48 Steel, Virginia	186	207	206	197	195	184	186	185	186	169	182	185	178	163	147	130	137	115	89	82	87	106	98	81	104	125	115	127	142	84	84	100	85	83	127	100	85	83	127	127.3
49 " Liverpool	137	123	127	129	136	106	113	136	115	104	108	119	120	114	93	89	93	88	80	80	85	85	89	90	83	84	84	88	104	105	115	107	112	84	90	100	91	69	88	102.6
50 Iron, English Bar	252	224	202	180	168	138	126	124	139	131	146	236	228	210	210	138	142	138	133	146	128	183	131	140	112	140	88	85	102	149	141	141	153	114	102	100	106	126	156	138.8
51 " Sheet	61	66	57	56	58	56	56	56	56	52	54	53	56	52	50	50	50	50	103	58	48	52	58	60	68	89	103	101	82	82	87	100	119	89	88	100	100	110	130	76.6
52 Nails, Wrought	—	—	—	308	297	291	298	295	295	276	272	272	308	301	302	306	306	284	268	292	288	280	282	—	284	284	284	130	183	213	183	184	152	110	87	100	91	86	240	249.2
53 Copper, Pig	92	85	82	86	86	81	83	82	77	75	76	86	87	79	78	85	83	80	78	81	80	82	84	86	80	80	81	80	100	131	112	118	110	105	119	100	—	—	—	84.8
54 Tobacco, Kentucky	74	67	64	51	71	69	58	51	62	56	100	89	85	110	140	103	103	82	80	81	81	80	80	85	79	80	100	81	82	101	119	138	117	115	108	100	107	187	202	94.7
55 " Manufd #1	80	63	58	60	58	56	56	57	61	65	60	61	78	104	83	82	85	83	89	83	89	92	89	70	104	120	89	102	95	89	88	140	141	113	100	100	140	213	200	88.8
56 Whiskey, Domestic	118	149	131	101	103	112	142	135	137	111	149	166	183	181	166	111	85	86	87	106	103	98	104	101	107	119	106	88	111	104	107	106	130	89	118	100	60	134	208	125.8
57 Brandy, Cognac	85	85	81	78	86	86	87	93	92	92	93	95	90	91	96	96	92	96	93	90	93	97	96	93	92	88	88	88	107	122	120	104	107	89	100	100	100	100	100	80.
58 Rum, Jamaica	61	69	76	87	80	83	77	77	73	70	81	80	83	85	101	111	116	108	104	102	115	114	111	115	116	111	130	131	115	106	100	100	100	100	100	100	100	100	100	100.0
59 Gin, Schiedam	88	87	104	108	107	114	127	128	129	133	124	121	133	132	148	146	141	141	137	137	137	145	152	148	136	140	141	140	131	140	123	128	110	108	100	121	135	131	131.1
60 Wine, Port	59	59	56	69	46	37	37	39	43	42	42	46	60	49	42	39	36	32	30	32	33	35	49	50	49	42	45	47	47	37	31	35	102	100	80	100	81	81	104	55.
61 " Madeira	75	75	75	71	55	52	51	45	46	44	46	46	44	46	58	48	45	31	34	45	39	40	49	50	61	60	58	62	62	59	64	77	82	80	86	100	100	100	100	100.0
62 " Claret	47	46	43	42	37	30	48	42	33	27	29	29	30	30	30	29	29	26	30	30	40	34	34	44	45	45	40	46	45	63	68	85	85	108	100	100	100	100	132	63.7
63 Glass, American	99	100	88	98	88	93	98	90	90	92	91	96	92	96	92	92	96	92	92	120	102	98	98	87	98	98	98	92	98	93	103	104	100	100	100	100	100	100	100	97.8
64 Tallow, American	80	81	83	79	84	82	90	80	84	70	82	83	104	103	117	90	75	70	69	69	68	78	87	80	75	88	87	86	87	116	117	108	107	86	102	100	87	86	118	84.6
65 Candles, Mould	66	69	72	65	59	56	63	70	70	65	63	69	73	84	84	71	70	69	57	58	56	63	69	69	84	84	84	82	87	86	82	79	79	102	110	100	86	101	118	74.6
66 " Sperm	92	89	81	70	61	61	76	86	89	81	86	89	86	105	108	100	75	82	81	79	71	80	86	83	111	118	105	88	79	86	103	110	106	108	100	88	97	88	122.9
67 Soap, N.Y. White	162	182	114	81	85	79	86	85	86	85	85	85	85	85	81	86	85	86	86	83	79	79	80	80	89	89	89	94	81	103	89	89	86	86	86	100	85	—	—	90.7
68 " Castile	84	70	108	114	108	99	112	129	116	119	142	129	138	129	127	116	136	143	119	107	91	87	111	107	95	89	89	102	107	104	104	102	105	84	100	100	100	120	114	108.6
69 Turpentine	86	74	86	81	82	88	88	86	95	119	128	130	91	74	77	84	78	75	76	84	103	118	89	80	82	78	84	103	148	133	101	95	110	100	118	100	342	420	247	98.3
70 Linseed Oil	138	131	126	136	134	136	166	157	157	133	140	138	143	136	140	121	148	153	138	131	138	139	116	100	110	134	130	110	116	134	148	148	134	110	106	100	102	158	138	138.
71 Paint, Red Lead	158	155	149	146	116	108	104	107	105	103	111	126	141	134	130	119	116	88	87	87	87	87	87	87	87	87	87	87	118	123	117	132	113	111	108	100	88	105	120	107.6
72 Oil, White	53	56	66	65	64	69	67	68	63	55	76	95	71	85	87	81	88	71	76	79	87	87	87	78	86	81	80	84	101	100	119	149	101	107	110	108	100	81	101	106	88.
73 " Sperm, Summer	42	47	46	52	47	49	53	56	63	58	59	62	61	69	75	70	67	58	65	63	69	64	73	75	77	83	80	84	82	123	135	130	83	85	107	100	90	101	115	72.6
74 " Winter	44	47	48	46	51	53	59	63	68	62	66	65	63	62	77	75	71	67	68	68	68	69	76	79	77	82	86	87	90	108	133	130	88	87	82	100	100	100	100	76.6
75 Whalebone	30	37	50	50	37	32	28	21	19	22	28	31	35	29	29	24	25	32	40	50	49	41	30	31	37	42	42	46	—	44	50	89	108	111	87	100	85	104	140	60.8
AVERAGE INDEX NUMBER	110.5	115.8	115.1	112.	112.	109.	113.	113.	110.	100.	112.	123.	120.	116.	119.	105.	99.7	98.8	93.	98.2	95.	95.6	100.2	92.7	98.2	99.4	99.7	96.3	106.	110.8	110.0	106.6	100.5	99.8	101.6	100.	94.7	106.	102.7	103.8

18 cents a pound. Other commodities were correspondingly high, as may be seen from Table I. Added to this, the crops in 1835 were a failure.* Wheat was imported in October,

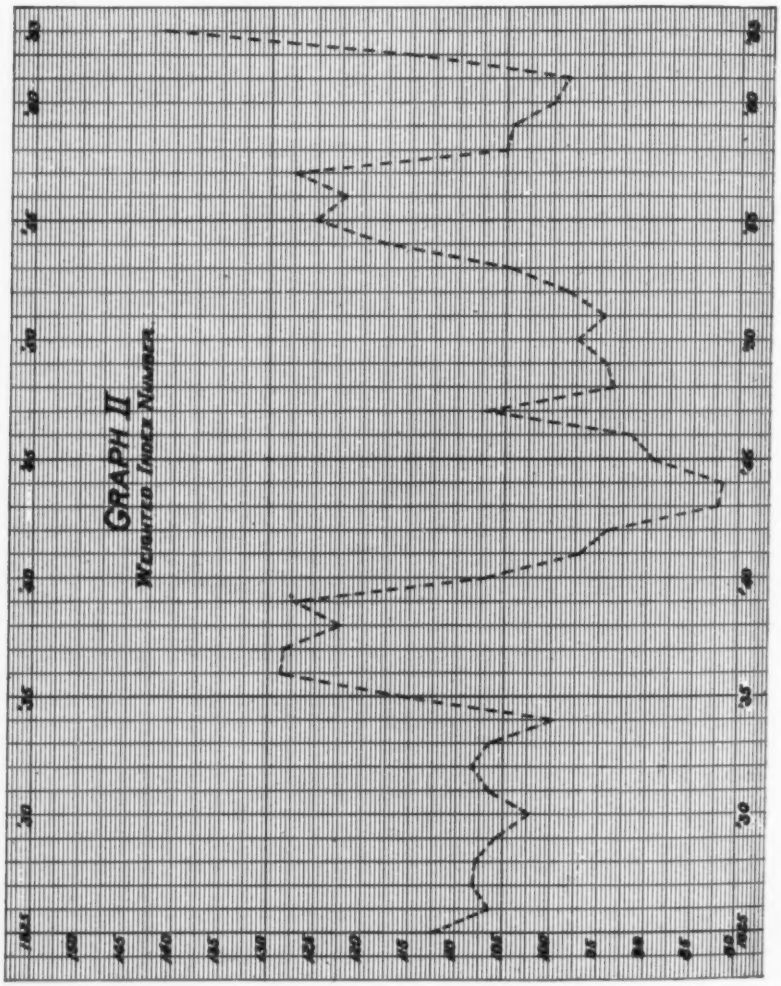


1835, and continued to be imported until the following spring. Flour was then quoted at from $8.00 to $16.00 per barrel.

On top of this crop failure came Jackson's specie circular.

* Benton, Thirty Years' View.

Even after that prices bore up for fourteen months longer. Then came the crash. In 1837 the imports into the United States for consumption fell to $113,250,000, a drop of $76,730,-



000 from 1836. The sales of public lands fell to $6,750,000, a decrease of $18,000,000. The values of urban real estate were in some places cut in half. Before 1837 money had been borrowed on the basis of the prevailing inflated values, and

with the collapse of credit it became almost impossible for debtors to meet their obligations. In Mobile, Alabama, about 90 per cent. of the merchants failed, and in New Orleans practically every important business house found it impossible to pay its debts. Industry was for the time being suppressed. There was no manufacturing; the mills were closed. In May, 1837, the banks suspended specie payment. The government expenditures were almost doubled in one year, and as a result the treasury experienced a deficit of about $12,000,000. The states fared even worse than the national government, and twelve of them repudiated their debts during the panic.

President Van Buren, who succeeded Jackson in 1836, reaped the whirlwind which Jackson had sown. With admirable nerve, ignoring thousands of petitions that voiced the popular distress and clamored for a change, he hewed to the line of policy that had been laid down by his predecessor. He did not lay the crisis at the door of Jackson for overturning the National Bank, but stated that the country must carry out the positive plan of being its own banker; that private and public finance must be separated.* He fathered the subtreasury system substantially as it exists today, and it was carried into effect in 1840, after Congress had hammered at it during all the interim. This left, nevertheless, the old, vexing question of the currency. The administration thought in line with democratic principles that the banking problem should be left for solution with the separate states. In 1837, by the president's recommendation, an extra session of Congress passed a bill authorizing the issue of $50,000,000 in treasury † notes; $40,000,000 of these were donated to the states in four installments.

This attempt to revive credit and business shows itself very distinctly in the curve of prices for the years 1838–39 (Graph I). The president in his message to Congress in the spring of 1839 states:

"By the curtailment of paper issues, by the sanguine and adventurous spirit of speculation, confidence has been restored both at home and abroad."

* Sargent, Public Men and Events.

† Finance Reports, 1863, pp. 313–315.

But a relapse followed in 1839–40 as appears from the sudden descent of the price curve from an index of 119 in 1839 to one of 105 in 1840. In succeeding years, while the fall is not so rapid, it still continues, until in 1843 it reaches the lowest trough of this wave, 89 per cent. The general suspension of specie payments in May, 1837, had been followed by a reduction of bank currency in 1838 from $169,000,000 to $116,000,000. In 1839 it increased again to $135,000,000, the banks then preparing for resumption of specie payments.* This had been effected in 1838 by the banks of New England and New York, but in the South and West resumption was not effected until 1842.

The Independent Treasury Act of 1840 provided that one fourth of the public revenues were payable in gold and silver after June 30, 1840, another fourth after June 30, 1841, another fourth after June 30, 1842, and after June 30, 1843, all public revenues, including postage, were made payable in specie. The results of this act were almost immediately apparent For this and other more significant reasons, the fall of the price curve is greatly arrested after 1842 until in 1844 it again begins to climb.

But in the year 1843 a remarkable depression in the prices of nearly all staple articles in the home market is noticed. Prime beef was sold in the New York market at $2.75 per barrel; hams at three and four cents per pound; unrefined sugar at four and five cents per pound; tobacco at two and three cents per pound; nails at four and five cents per pound; cotton at five and six cents per pound; and hops at six and seven cents per pound. Articles of foreign production were also held at prices much lower than in previous years: viz., coffee, six to seven cents per pound; port wine, fifty cents per gallon; Scotch pig iron, $22.50 per ton.† The influences of the tariff of 1842 were felt in the better prices which prevailed toward the close of 1843. In 1846 a general reduction of tariff duties took place; but trade conditions were steadily improving, and prices accordingly rose. The ten years 1846 to 1855 constituted a period of unusual economic development, and

* Finance Report, 1863, p. 311.
† Finance Reports, 1863, p. 321.

this is especially true of the years 1846 to 1850. At this time railway construction was in full swing; transportation facilities by land and water were being rapidly improved; and many new inventions of great importance, such as the telegraph, were being introduced.

We see from the graph of the general index number that beginning with the year 1848 this price curve takes another series of ambitious upward dashes. If the curve were smoothed from the beginning to the end of the whole period, it is notable that there would be a steady descent to 1848, then a steady rise for the rest of the period. Practically the same phenomenon occurred in the English price movement of this period, and formed the subject matter of Jevons' classical investigation of the amount of price inflation ascribable to the influx of Californian and Australian gold. In measuring this inflation Jevons used two methods. First, following a previous investigation by Cobden, he ascertained the average ratios of the prices of fifty chief articles of English commerce during the years 1850 to 1869, in relation to their average price in the year 1849. Secondly, he compared the two years 1858 and 1867 in which prices were lowest after the influx of new gold, with the prices in 1849, and found by this comparison what may be called the elevation of the normal price minimum. The two computations led Jevons to conclude that a permanent rise in prices of 18 per cent. had been accomplished. This, said Jevons, can only be attributed to the gold influx, since the other causes that entered to influence prices were at work as well before as after 1850; and since, according to Professor Cairnes, "the effect of these (the gold) discoveries is probably much greater than we can prove, because the course in prices was in previous years decidedly downwards, so that the new gold has both prevented a further fall and occasioned a rise in its stead."*

The following table supplies a comparison of our index numbers with the data from which Jevons computed the above result. The American index numbers have been recomputed on the basis of prices in 1848. The latter year was made the datum line for this comparison, because it

* Jevons, Investigations in Currency and Finance, pp. 152–159.

marks the lowest point of prices in this period, whereas the year 1849 marks the minimum price level in the table of Jevons.

Year.	Jevons Average Ratio of Prices to those of 1849.	Our Average Ratio of Prices to those of 1848.
1847	122	116.5*
1848	106	100.0
1849	100*	102.9
1850	101	108.8
1851	103	109.1
1852	101	109.8
1853	116	119.7
1854	130	128.7
1855	125	132.2
1856	129	130.4
1857	132	137.2*
1858	118*	113.5
1859	120	115.8
1860	124	114.0
1861	123	.....
1862	124	.....
1863	123	.....
1864	122	.....
1865	121	.....
1866	128	.....
1867	118*	.....
1868	120	.....
1869	119	.....

* Points of lowest price.

Following Jevons' methods, so far as our more limited data permit, it appears from the table that the normal price minimum was raised from a point represented by 100 in 1848 to a point represented by 113.5 in 1858—an increase of 13.5 per cent. The average of these index numbers for the years 1849 to 1860 inclusive—the war prices have to be ruled out in the American comparison—is 118.5 as compared with 100 in 1848.

Probably a better method of measurement for this country is found in a comparison of average prices in the ten years preceding 1848 with similar average prices in the ten years following 1848. Such a comparison was made and indicates that the price level was about 8.3 per cent. higher in the latter decade. Similarly the differences between the medians of the indices for ten years before and after 1848, made relative to

that year, was found to be from 5.2 to 10.7 higher for the latter ten years. In general it appears from these results that the effect of the new gold discoveries was somewhat more moderate in the United States than in England. This difference may be due to the fact that our measurement embraces three periods of business collapse and only two boom periods, while in the range of Jevons' later investigation the lean and fat years were more evenly represented.

From this brief discussion of the effect of the gold discoveries upon prices, we may return to note some of the other influences affecting the price movement. The Crimean war occasioned a large demand for breadstuffs and provisions from the United States. This is apparent in the higher prices of these commodities in 1855 over 1854. The importation of woolen and cotton goods and of iron was encouraged in following years by the reduced tariff which took effect in 1857. This necessitated the exportation of a large balance in coin and bullion, which may in part explain the relatively greater rise in prices in England as seen by Jevons' index numbers for these years.*

The years 1848 to 1857 were gala years of prosperity with only slight relapses in 1855 and 1856, an effect of the autumn of 1854, when there was a stringent money market and hard times, due to a panic in Wall Street. A noticeable depression is indicated by the price curve for 1855 to 1856. The succeeding year shows a brisk revival, and the curve mounts 4.4 per cent. more than it fell the previous year.

But after 1857 another serious crisis forces the index to drop from 120.3 to 99.5, which is the greatest drop for any one year during the period. This panic was caused by venturesome railroad building from 1846 to 1857. The speculation in stock and real estate was nearly as reckless as it had been in the years of 1834 to 1836,† and the Western banks were again indulging in an almost unchecked issue of paper money. As a result there was much extravagant living and an increased consumption of European luxuries. Horace Greeley wrote in 1857: "Set thy house in order; we are on the eve

* Jevons, Investigations in Currency and Finance, p. 46.
† Blaine, Twenty Years in Congress, Vol. I., p. 207, ff.

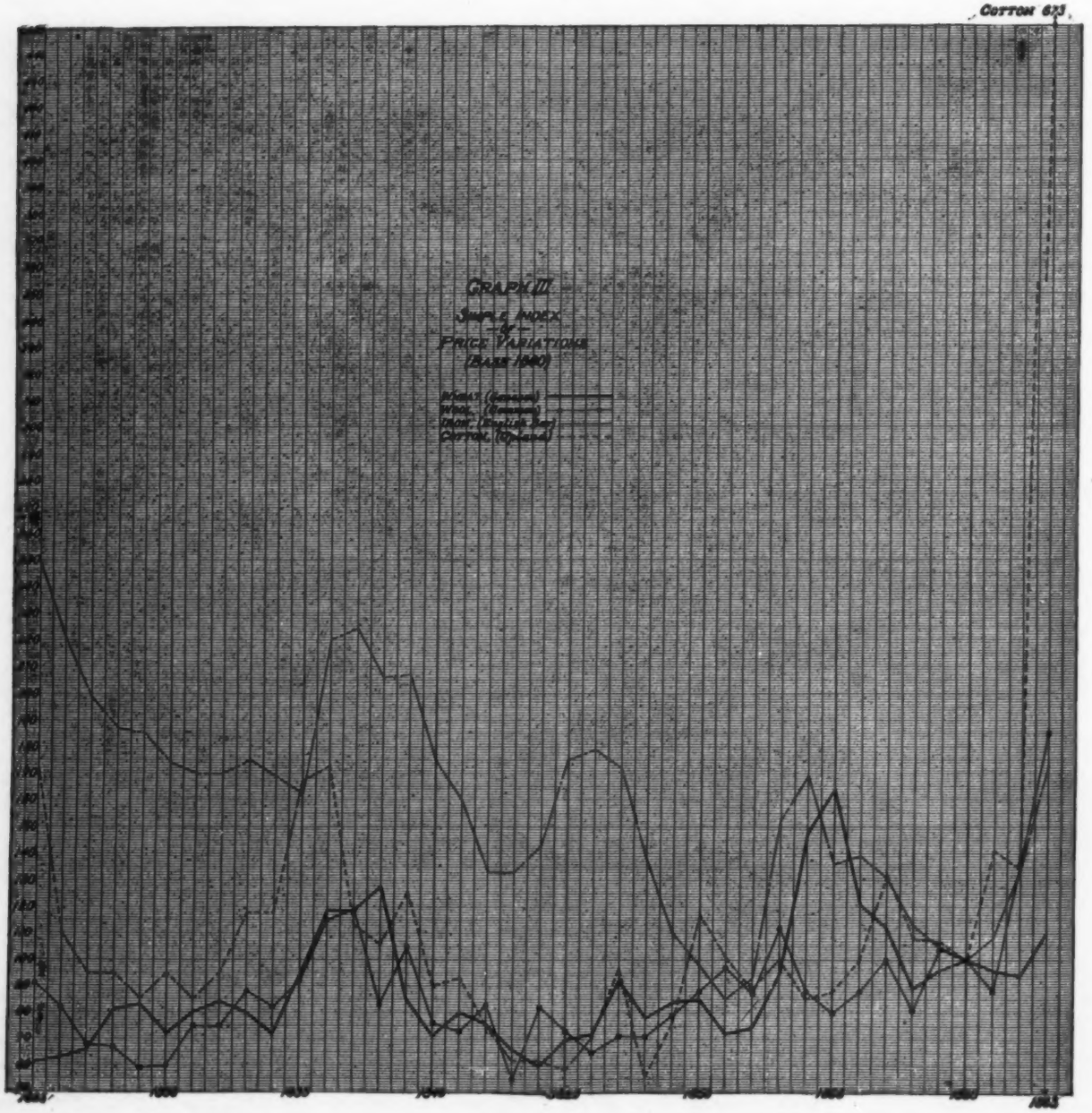
of great financial trouble, for we have run too deeply in debt abroad. We are heavily in debt in Europe. Our merchants and bankers owe those of Great Britain and the continent. The country owes the cities, the farmers owe the merchants, two thirds of us are in debt."

Many explained the crisis as a direct result of the tariff of 1846, which induced the heavy buying of goods abroad and drained the country of specie to settle an unfavorable balance of trade. But it is safe to say that the paltry tariff reduction of five per cent. in the years 1846 to 1857 did not have such a great influence as politicians tried to establish. Overspeculation, caused by expansion of bank loans, inflated credit, and the stimulating influence of new gold are nearly if not quite sufficient to explain the depression.

By July, 1857, the general complaint of hard times was heard. When in August the Ohio Loan and Trust Company of Cincinnati failed, panic immediately resulted. Bankers and brokers were unable to meet their obligations. Deposits and consequently loans contracted in volume. The interest on loans rose by 3, 4, and 5 per cent. in one month. In September the banks of New York, Philadelphia, and New England suspended specie payments, as did later financial institutions all over the country. Merchants and manufacturers failed everywhere. The decline in prices was alarming, as is seen from the price curve. Flour and pork fell from an average price of $5.96 and $19.95 per barrel, respectively, in 1857 to $4.29 and $17.19 in 1858. The prices of almost all commodities depreciated from 25 to 75 per cent. Wages fell off. In New York City alone there was an army of thirty to forty thousand of unemployed. Rich and poor suffered alike.

But the panic was of short duration. In the next spring recovery is apparent. Gold came from England and California. Specie payments were resumed. Prices rose.* The machinery of commerce was once more able to speed up. During the summer of 1858 money was easy again. But in 1859 and 1860 a decline in the general price level is noted.

* Blaine, Twenty Years in Congress; Schouler, History of the United States, Vol. IV, p. 386, ff.


GRAPH III
SIMPLE INDEX
OF
PRICE VARIATIONS
(BASE 1880)
WHEAT (Bengal)
WHEAT (Bombay)
WHEAT (London Gaz)
COTTON (Bombay)
1880
1890
1900
1910
1920
1930
1940
1943

This decline continued at a slightly increased rate during the next year. It was probably due to the set-back to our national commerce caused by the growing gulf between North and South.

If we confine attention to the relative prices of the separate commodities, the economic law, laid down by Cairnes* and confirmed by Jevons, is revealed: that vegetable products are much more variable in price than animal products, since the former depend entirely upon the seasons. Hops are the most variable, as may be seen from Table II. They range in price from an index of 51 in 1828 to 303 in 1840. As might be expected, the grains,—wheat, rye, and oats,—are next in order of variableness.

The addition of the cost of manufacture to the price of the raw material ought, it would seem, to steady the price of the completed commodity. This seems to be confirmed by the statistics. Thus in 1843, when crops were unusually bad, wheat dropped from an index of 76 to one of 66. Wheat flour dropped only from 96 to 92. Other commodities of the list show the same to be true, even though the manufacturing process that entered into them was but slight. If there were enough manufactured articles in our list to justify such a study, it would be interesting and valuable to note what respective effects slack and prosperous times have had on the variableness between raw and manufactured products.

In Graph III the simple index numbers of four commodities, wheat, wool, cotton, and iron, have been plotted. The curves of these are seen to be much more irregular than the curve of the general index, showing clearly how the conditions governing any one commodity or even a restricted group of commodities, cannot be made a criterion, except in a very general way, of the general tendency of a market. This is so even though yearly averages be taken. There is only a general correspondence, in these separate commodity curves, to what one expects to find after having studied the general index curve.

Wheat begins the period with a tendency contrary to what

* Essays in Political Economy, Theoretical and Applied, 1873.

would be expected, although the other three commodities have the same downward tendency which we noted in the general index curve. The rise of wheat in times of falling price can not be explained except by poor harvests of this staple, especially in foreign countries.* In times of wide commercial distress, as after 1825, the tendency will also be for the necessaries to remain constant in price, while the luxuries and articles that may be dispensed with when money is tight fall in price. This tendency of wheat to remain constant in times of price depression, its scarcity at home and exportation abroad would seem to explain the rise of wheat in these early years of the period. Throughout the whole period the variations in price of wheat are less than the fluctuations of the other three articles. If the curve of wheat were smoothed it would show a general rise after 1850. This is also true of the other commodities that have been graphed.

Iron fluctuates most in price. It illustrates very plainly Carnegie's saying that the iron and steel business is either a prince or a pauper. With almost vertical ascents in the boom years, 1835 to 1836 and 1852 to 1853, it falls almost as steeply from 1839 to 1842 and 1854 to 1859. It is remarkable that in the latter years the fall in iron predated that of the general index by about three years. This was doubtless caused by the large importations which then competed with home-produced metal, for the tariff of 1846 encouraged the importation of iron. The other fluctuations of iron, except the unusual fall from 1847 to 1851, are quite in conformity with the general index curve, though more pronounced.

Cotton has a peculiar course. It makes a deep descent from 1825 to 1827, then bobs up and down in about equal measure until 1831. There it begins a great rise, which holds out till 1836. Then it falls, following the general course of prices roughly, with slight recoveries in 1838 to 1839 and 1840 to 1841. The low point of this trough is reached in 1845. After that, beginning a year later than the rise of the general index, it mounts for two years, then falls to the lowest depth of trough in 1848. In this respect cotton alone corresponds with the general index number. Wheat has its minimum

* Journal, London Statistical Society, Vol. XLII, p. 260.

TABLE III: WEIGHTED INDEX NUMBERS OF YEARLY AVERAGE PRICES — NEW YORK MARKET — 1825 — 1863: (BASE: 1860).

	Weight	1825	1826	1827	1828	1829	1830	1831	1832	1833	1834	1835	1836	1837	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863
1 Beef, Prime	3	1297	1071	1358	1406	1548	1287	1206	1178	1242	1278	1853	2548	2489	1809	2385	2380	2490	1284	616	1035	782	1152	1152	1382	1280	1863	1360	1107	1161	1153	1404	1872	1674	2116	1530	1214	1000	874	1143	1116
2 " Mess	3	1550	1393	1562	1594	1592	1568	1478	1647	1622	1519	2128	1893	2405	2558	2024	2369	1588	1316	1442	891	1942	1318	1988	2618	2056	1578	1558	1863	1583	1888	1998	2857	2538	1867	1823	900	986	1368	1166
3 Pork, Prime	3	365	285	320	370	415	380	410	415	425	385	425	650	580	580	585	425	385	255	310	235	280	355	440	520	545	520	450	535	515	450	620	615	740	530	625	800	865	590	665
4 " Mess	3	350	320	365	375	350	365	325	390	405	390	460	645	580	535	535	495	385	235	270	340	350	500	495	510	500	395	340	450	500	450	520	525	680	500	580	650	745	565	665
5 Smoked Ham	1	85	69	76	68	69	71	73	69	67	83	70	91	90	82	84	89	—	—	—	—	—	—	—	—	—	—	—	82	71	71	71	89	140	140	140	140	140	140	—	—
6 Lard	3	257	185	228	171	147	216	243	226	225	213	232	334	228	288	342	241	182	169	166	183	185	183	243	185	174	188	148	215	228	248	273	383	383	273	242	300	240	215	216
7 Pork, Dry Cod	2	130	110	136	162	132	135	148	152	142	144	165	176	180	188	200	195	156	118	128	140	148	196	186	148	132	136	134	180	164	176	200	202	184	170	210	200	150	202	208
8 " Mackerel #1	2	89	82	84	84	86	90	76	74	80	74	86	116	118	136	138	132	102	106	110	130	150	124	120	102	88	130	110	120	172	202	240	252	224	152	180	200	140	168	210
9 Butter, Western, Daily	6	330	328	408	380	336	332	364	368	380	388	480	648	636	684	660	648	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588
10 Cheese, American	1	76	78	78	59	59	59	59	59	68	82	76	89	91	79	84	76	67	69	59	69	69	70	71	69	62	69	61	71	87	89	87	92	96	97	85	100	78	78	146
11 Wheat, Genesee	10	810	630	648	810	630	720	810	900	840	800	720	940	1180	1180	1180	1080	810	780	660	660	600	700	780	920	780	840	810	720	960	1080	1260	1210	1120	1080	850	960	1000	960	1040
12 Wheat, Flour, Superfine	10	1000	940	1000	1000	1260	970	1110	1180	1080	970	1080	1460	1760	1520	1480	1080	1030	1170	960	920	860	1080	1270	1180	1090	1080	980	970	1080	1260	1290	1160	1080	980	1000	970	980	1080
13 Rye, Northern	6	330	510	492	390	480	468	570	606	582	480	660	768	810	702	744	642	642	624	630	642	606	540	780	534	498	468	534	582	672	846	972	606	624	528	618	600	516	576	726
14 Rye Flour, Fine	6	474	600	576	516	618	528	648	726	642	564	720	948	1092	864	792	516	516	516	504	528	504	528	588	744	642	498	486	498	588	678	960	1080	1080	672	528	648	600	636	576	576
15 Corn, Northern	6	300	408	328	328	306	304	380	372	396	356	408	498	522	468	462	360	300	324	336	348	330	336	426	360	336	360	336	336	384	468	528	600	660	432	414	480	384	336	468
16 Corn Meal, Northern	6	312	468	360	312	308	282	414	384	438	358	426	528	540	432	512	360	348	332	308	292	384	416	468	320	328	312	384	384	480	540	576	624	624	480	312	372	468	384	468
17 Oats, Northern	3	231	342	291	216	252	231	270	327	294	255	330	378	378	294	336	246	216	210	231	273	282	324	300	276	210	234	273	309	306	336	384	408	390	375	324	345	300	276	348
18 Rice	3	218	216	232	231	218	186	225	246	234	213	282	330	348	315	341	246	265	207	185	232	236	260	303	234	210	234	222	233	204	348	333	366	351	240	270	360	360	312	438
19 Hops	1	137	182	101	51	67	88	88	138	216	116	116	111	66	58	131	303	187	82	76	67	115	180	76	36	68	107	286	236	184	287	145	60	62	60	81	100	128	128	169
20 Cheese, Bread	4	508	408	440	368	384	332	328	356	336	348	336	336	332	296	296	304	296	296	272	176	208	208	208	176	200	368	264	264	296	296	296	320	328	360	272	400	304	264	368
21 " Skim	4	432	420	420	356	364	364	308	320	320	300	336	336	336	300	300	312	292	272	216	242	204	212	200	176	196	312	248	276	288	296	316	312	360	400	344	412	268	276	404
22 Tea, Young Hyson	3	330	306	323	312	300	284	328	326	260	204	210	252	206	184	212	246	200	214	200	262	200	186	182	170	166	152	170	170	180	162	158	156	162	150	96	200	200	206	168
23 " Gunpowder	3	408	332	436	410	406	392	414	328	234	184	180	208	208	180	180	208	204	232	200	248	238	224	204	174	206	208	238	188	176	182	140	116	166	178	136	200	174	206	348
24 " Imperial	2	816	758	764	788	780	784	840	816	496	384	384	440	470	472	480	—	460	388	382	486	396	348	348	328	364	348	324	284	326	348	344	348	324	284	245	146	208	208	208	328
25 Molasses, New Orleans	3	146	142	150	140	156	156	132	156	156	126	156	156	156	156	140	114	108	108	98	108	120	156	144	108	110	116	130	120	158	106	156	210	200	186	126	210	200	160	182	210
26 " Sugar House	2	380	324	332	274	274	242	290	221	252	182	216	290	264	248	228	178	164	158	146	182	178	174	182	158	132	152	132	148	138	132	210	232	328	186	182	240	158	208	318
27 " Muscova	2	256	236	264	258	230	208	216	228	238	206	234	314	342	230	254	182	150	138	136	218	206	184	182	164	174	164	162	164	184	182	184	188	240	358	184	280	182	260	318
28 Sugar, New Orleans	3	354	344	336	333	303	318	255	236	240	282	306	321	291	294	261	255	267	185	237	264	255	228	288	174	207	228	238	185	204	210	243	330	380	296	271	300	270	303	408
29 " Manilla	3	432	387	396	396	354	330	321	287	342	330	330	417	342	327	321	267	288	213	270	291	288	312	288	186	210	240	234	213	213	255	264	327	384	288	291	360	258	345	426
30 " Loaf	3	498	498	528	549	540	528	483	474	498	468	468	492	474	417	474	381	366	318	330	339	321	330	360	258	288	288	255	243	252	273	264	327	327	300	330	264	261	357	438
31 Salt, Liverpool	1	288	256	248	228	254	218	211	220	202	173	185	210	218	194	173	146	160	144	141	148	149	163	148	131	148	132	148	136	116	102	88	78	84	100	80	101	105	—	—
32 " Turks Island	1	233	268	300	263	255	247	268	258	231	203	188	288	282	211	288	178	168	—	147	—	146	132	180	132	136	134	119	113	181	267	231	158	116	82	87	100	105	153	214	—
33 Pepper	1	240	237	236	213	183	183	183	205	183	84	101	110	98	98	110	87	82	100	110	137	156	156	87	96	70	85	110	134	144	144	145	152	158	110	110	100	110	215	348
34 Rhubarb, Manzolini	1	143	130	98	108	113	98	89	110	86	82	118	87	96	89	89	89	79	59	69	80	87	85	91	65	63	106	84	114	109	135	163	95	85	100	76	134	141	—	—
35 Nutmegs	1	403	311	311	330	330	330	347	340	297	244	328	380	253	278	240	200	184	181	203	335	234	331	303	253	210	255	231	267	282	257	241	230	168	138	118	100	100	103	168
36 Olive Oil	1	76	66	72	63	63	76	76	77	82	76	63	89	76	68	85	89	104	76	87	73	72	79	82	64	74	79	68	84	89	89	85	89	104	83	89	100	80	104	142
37 Wool, Common	3	228	246	228	201	177	180	228	225	264	246	276	345	327	309	315	228	216	186	165	252	216	186	219	213	237	228	231	231	256	246	240	264	294	312	300	264	264	258	258
38 " Pulled	3	324	285	213	240	249	279	543	426	468	459	456	636	417	342	483	234	306	201	231	318	303	234	231	276	201	324	345	324	336	303	249	309	333	246	318	300	267	309	306
39 " Merino	3	231	232	234	228	252	231	306	282	264	264	330	327	342	231	306	234	204	162	183	240	210	186	213	207	216	243	258	240	300	252	225	270	294	234	228	300	228	318	420
40 Cotton, Upland	10	1700	1090	980	850	850	850	850	810	1190	1190	1870	1350	1190	1090	1360	1020	850	850	630	680	850	1190	1020	850	760	1190	1020	850	850	1020	1360	1080	1020	1080	1360	1360	1360	1700
41 Cloth, Russia, White	1	—	142	115	105	105	113	112	111	105	91	87	112	118	115	112	103	107	107	104	102	95	104	97	97	100	100	100	100	100	100	100	—	—	—	—	100	—	—	—
42 " " Brown	1	—	108	103	93	105	111	109	103	87	86	87	113	117	108	102	96	87	82	86	96	86	86	108	101	106	106	101	88	87	98	—	—	—	—	—	100	—	—	—
43 Kid, West Indies	2	130	118	104	112	106	114	128	110	104	84	108	108	88	82	108	108	—	108	—	104	108	96	100	96	80	102	110	116	102	108	130	130	126	110	116	116	116	116	116	116
44 " La Plata	2	120	140	136	138	126	138	134	132	116	106	116	116	116	130	136	140	130	102	98	96	96	96	94	84	102	114	126	134	136	96	94	84	234	234	210	240	234	234	234
45 Leather, Hemlock Sole	2	218	198	180	198	198	186	204	182	176	160	180	174	186	192	208	174	184	176	152	148	138	140	148	132	168	168	158	164	176	206	212	244	232	204	232	232	206	216	234
46 Piece, Bunker	1	450	480	428	612	630	630	495	468	387	387	459	492	459	459	459	459	432	387	387	231	231	258	231	285	285	285	285	285	285	285	285	180	180	119	149	183	183	119	180	180	180	180	180	180	252
47 Cod, Pinyfish	3	438	621	618	591	654	492	396	585	384	327	348	384	585	522	528	341	330	312	345	369	378	321	318	300	294	303	318	325	345	321	321	336	282	288	330	264	264	264	291
48 " Liverpool	3	411	393	381	387	372	369	336	408	385	309	324	357	360	339	270	237	294	282	267	294	315	255	261	294	270	282	252	273	327	351	285	288	261	248	273	300	225	264	258
49 Fish, English Bar	2	180	492	398	324	320	348	360	390	350	328	324	498	468	432	426	330	330	288	288	288	357	348	348	276	240	186	170	186	304	336	252	270	264	228	210	240	210	240	306
50 " Shad	2	131	128	118	110	112	102	112	112	110	96	106	118	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
51 Whale, Wrought	1	—	—	—	286	287	287	285	295	285	278	272	272	306	301	287	306	306	284	280	280	280	280	280	312	—	284	284	284	170	183	213	183	156	156	110	87	110	87	96	148
52 Clipper, Ply	1	92	85	82	84	86	81	83	82	77	75	76	96	87	79	79	87	83	80	79	81	80	82	82	84	84	80	80	81	80	119	131	118	118	110	119	119	100	—	—	—
53 Tobacco, Kentucky	4	236	248	256	284	284	256	224	284	268	284	400	336	300	440	640	404	412	240	240	284	284	240	240	264	304	304	432	324	348	404	476	556	288	344	400	460	740	1000	1000
54 " Leaf #1	4	320	252	232	232	232	216	216	224	228	224	224	320	324	404	316	416	272	272	236	240	252	252	252	288	272	280	324	310	332	344	396	444	520	448	432	400	480	432	432
55 Whiskey, Domestic	2	236	258	262	280	296	294	284	270	274	252	298	332	328	332	334	272	180	170	184	232	208	182	262	216	214	224	208	188	232	248	324	288	240	188	228	200	180	332	476
56 Brandy, Cognac	2	50	50	62	58	58	58	74	68	64	68	68	70	60	68	68	68	68	68	68	68	68	100	106	114	112	108	104	102	110	110	102	210	244	232	240	230	188	200	204	204	306
57 Rum, Jamaica	1	61	69	76	84	80	79	77	72	73	70	68	80	80	80	80	80	80	80	80	80	80	100	108	114	115	131	115	107	102	108	98	116	132	131	130	103	98	90	114	132
58 Gin, Schiedam	1	89	87	108	108	107	114	132	128	128	123	124	131	133	131	128	126	131	131	126	126	127	128	132	127	135	140	101	98	130	130	123	122	103	110	105	100	121	105	131
59 Wine, Port	1	59	59	56	58	46	39	37	39	44	42	42	42	52	44	42	39	36	32	29	40	33	35	32	53	53	43	49	42	43	52	74	85	105	100	88	100	69	63	105
60 " Madeira	1	75	75	78	71	55	52	51	45	46	44	45	48	58	50	45	51	38	44	39	42	43	52	52	52	51	51	51	52	52	59	63	77	92	80	85	100	116	116	116
61 " Claret	2	84	80	86	84	74	70	82	84	68	54	58	58	80	80	78	79	58	48	48	72	66	64	68	68	100	80	80	80	80	80	104	104	100	100	216	200	200	200	200	210
62 Glass, American	1	88	100	98	98	98	90	88	80	88	86	86	86	82	80	82	82	82	82	82	82	82	82	160	102	98	88	87	90	88	90	82	82	88	88	102	100	100	100	100	100
63 Tallow, American	1	80	81	83	78	84	82	80	58	94	70	68	83	104	103	112	81	75	70	60	68	68	70	78	87	80	75	69	67	82	87	115	117	100	107	85	107	100	87	86	112
64 Candles, Mould	1	89	86	72	65	89	84	83	70	70	65	63	69	73	64	64	71	70	58	57	59	65	56	63	69	84	67	64	83	79	79	107	112	100	96	101	116	—	—	—
65 " Sperm	1	72	69	81	70	61	61	74	84	68	81	86	88	86	86	105	104	100	75	69	81	74	71	80	84	83	111	116	105	84	79	85	103	110	104	108	100	83	79	79
66 Soap, New York White	1	82	187	114	81	85	78	85	85	82	85	85	85	85	85	91	84	86	86	86	83	79	78	80	80	80	80	80	79	81	102	80	86	86	85	85	100	85	—	—
67 " Castile	1	96	70	108	114	108	98	112	128	115	119	142	139	138	127	115	130	143	118	80	81	82	87	111	107	85	80	82	87	102	107	104	108	115	84	100	108	118	108	108
68 Turpentine	1	85	78	86	81	82	88	68	84	98	110	146	189	81	78	77	89	78	75	79	84	103	112	89	88	82	79	84	103	148	133	101	84	110	108	112	100	39	43	79
69 Linseed Oil	2	232	262	232	232	268	236	232	316	314	248	276	236	284	272	228	242	288	306	278	282	234	258	232	280	220	248	258	230	228	248	236	268	248	230	220	200	200	210	230
70 Paint, Red Lead	1	150	156	148	140	116	106	104	107	105	103	110	126	161	136	138	119	116	89	87	87	87	87	87	87	89	103	87	87	119	123	117	132	113	110	100	89	89	126	126
71 Oil, Whale	2	146	112	132	132	126	138	134	116	106	110	132	180	142	130	134	132	132	142	140	148	134	134	144	136	142	138	138	138	240	230	208	332	284	298	276	298	182	242	332
72 " Sperm, Summer	2	84	84	88	104	98	88	106	110	128	108	118	124	132	118	150	142	134	108	82	126	128	126	148	150	154	146	126	130	184	248	238	258	188	170	214	200	—	—	—
73 " " Winter	2	88	90	96	92	102	106	118	136	138	124	148	130	146	134	154	150	142	110	96	136	134	126	150	132	164	164	122	130	180	212	210	230	190	178	200	200	218	218	238
74 Whalebone	1	30	37	50	50	37	32	28	21	19	22	29	31	25	24	23	28	25	32	45	50	43	41	38	31	40	42	42	48	—	44	50	68	108	111	87	100	65	106	106
Weighted Index Nos		112.4	106.2	108.1	107.8	105.8	102.2	106.8	108.6	106.5	99.8	111.6	120.7	120.4	122.5	122.2	104.6	97	94.2	92.4	87.8	89.4	91.7	102.1	95.5	94.3	93.3	94.6	94.9	104.8	117.0	126.5	130	122.8	105	104.8	100	93.8	116	120.3

price in 1844, wool in 1843, and iron in 1851. After 1848 cotton has a general bobbing ascent throughout the rest of the period. In 1862 it mounts skyward faster than any other commodity except wrought nails. This jump in price of cotton is readily explained by the great fall in its production in consequence of the war in the South.

Wool has a very irregular course. It follows the general downward trend of prices until 1829. The high prohibitive tariff of these early years discouraged the woolen industry. But in 1832, when this condition was removed, the price of wool mounted by bounds. It conforms generally to the course of average prices, except that it is never affected by such great rises in the boom periods. The railroad boom before the panic of 1857 did not so markedly raise its price as it did the price of iron and wheat. Cotton showed the same tendency as wool at this time, although cotton was as much affected by the speculation preceding 1837 as was iron, while wheat and wool were about equally affected in a less degree. Wool has many more lesser fluctuations than any of the other commodities. This is doubtless because it was not traded in as extensively in the market, but bought and sold mostly in jobbing lots.

MEDICAL AND PHYSICAL EXAMINATION OF SCHOOL CHILDREN.*

By Frederick L. Hoffman.

The results of education require to be considered in their mental, moral, and physical aspects. Heretofore the last has received but superficial consideration, and while there is a well-established relationship between the physical and the mental conditions of children, the interdependence of the two as a fundamental condition precedent to school efficiency is a principle which has only been recognized in comparatively recent times.

A vast amount of school experience is not made a matter of record, nor are the results of such observations as have been made preserved with sufficient care and utilized for practical ends. The record of the child during its school life should include a reasonably full account of the child's personal antecedents, traits, and characteristics as determined by intelligent observation or by means of accurate physical measurement. The card system lends itself better to this purpose than the recording of such facts in books of record, or on loose sheets which are easily lost or destroyed. Since a considerable amount of information is required, it seems best to adopt a triplicate card system, one card being used for the personal record, one for school attendance, and one for moral defects and delinquencies. The most comprehensive inquiry should be made at the child's entrance and the essential facts then obtained should constitute the basis of subsequent inquiries as to a possible relationship between personal traits and the results of the educational processes to which the child may be subjected.

The personal record should include the sex, date of birth, family history, a record of illness previous to school admission, whether the child is the first born, the second, the third, etc., whether the father or mother, or both, are living or dead, and any other important facts of this nature.

*Introductory remarks by President Hoffman at the quarterly meeting of the American Statistical Association, Cosmos Club, Washington, D. C., April 14, 1911.

The school attendance should include information as to the causes of irregularity and absence, whether due to sickness and if so the cause thereof, whether due to truancy and if so the methods of correction, etc.

The personal inspection of the child, which should be made if possible at least once a week, should include information as to clothing, foot gear, and bodily cleanliness. The information as to foot gear is of considerable practical importance on account of the close relationship of defective shoes, thin soles, etc., to the occurrence of respiratory and other diseases.

The bodily inspection, which should by preference be made by a regularly employed school physician, should include the condition of the teeth, nose, throat, the presence of glands, external diseases of the eyes, the normality or abnormality of vision, external and internal diseases of the ear, normal and abnormal hearing, disorders of speech, differentiating stammering from stuttering, mental condition, the condition of the lungs, predisposition to tuberculosis or actual presence of the disease, the condition of the heart and of the nervous system, evidence of rickets, spinal deformities, particularly spinal curvature in its incipient stage and, finally, evidences of acute infectious diseases and proof of vaccination. To these may be added the temperature in suspected cases of fever, and the blood test in suspected cases of anemia.

The anthropometric measurements should include at least the measured height, the measured weight, and the measured inspiration and expiration of the chest. These should be amplified by general observations as to the state of nutrition and physical development to determine possible definite evidences of malnutrition or underfeeding.

Foremost among the statistics which are required for an intelligent understanding of the actual conditions of school life as they relate to the school population as a whole are returns of the age distribution of pupils by sex according to grade. Only a few state reports contain information of this character, one of the best being that of the Board of Education of the State of Connecticut.

Statistical data concerning physical defects or deformities as well as statistics of proficiency, determined by the usual

school methods, should conform to the classification of pupils by ages and grades.

The practical importance of this suggestion is brought out by the investigation into the physical condition of children attending public schools in New South Wales, with special reference to height, weight, and vision. It is said in that report that "of the many comparisons which the anthropometrical survey of public school children in New South Wales enables us to make, none is more interesting than that which shows the relation of the physical growth of the children to their mental development." It is shown by the tables contained in the report that the growth in physique corresponds remarkably with the progress of the children in the various school classes; and, for illustration, it is shown that the average ten-year-old boy in Class I measures 50.9 inches in height; in Class II, 51.3 inches; in Class III, 52.1 inches; in Class IV, 52.4 inches; and in Class V, 53.2 inches. The facts, therefore, warrant the conclusion that, taking a number of children of the same age, those who are best developed mentally are also those who are best developed physically, as measured by stature. A similar conclusion results from an investigation of the attained weights, and apparently the rule is well established that at any given age the higher the child's mental development the better, other things equal, will be the child's physique.

Obviously, there is an imperative need of precision in the terms used as well as uniformity in the methods of measurement employed. Inadequate statistical definitions are the chief source of error in statistical comparisons. While uniformity of procedure is difficult to secure, it is so much more a necessary requirement that the unit adopted shall be fully explained and that the method of measurement or examination made use of shall also be stated in detail. As far as practicable, only standardized medical and anthropometric apparatus should be used, for example, such as has been approved by the American Association for the Advancement of Physical Education. It makes quite a difference in height whether the measurement is taken with the shoes on or off, and it makes a considerable difference in weight whether the same is ascer-

tained in the summer or in the winter, or without the outer garments, or in the nude. These difficulties can easily be overcome, and past experience has shown that it is possible to correctly measure, by statistical methods, the influence of physical condition upon the educational progress of children at school.

Among the numerous new questions concerning which it would be of great value to have definite statistical information, as a basis for required educational reforms, I would place first of all the accurate determination of the child's visual power, including not merely visual strength but the probable degree of astigmatism. It should be stated in the reports whether the children examined wear spectacles or not, and the use of *glasses* instead of well-fitting spectacles should be absolutely prohibited, at least in school, as incompatible with the modern theory of proper adjustment and visual correction. It is seriously open to question whether teachers are fully qualified to determine more than approximately the acuteness of eyesight in school children, but it must be self-evident to anyone familiar with the facts that only a specialist in refraction work can determine accurately the occurrence of astigmatism, which is probably much more common than generally assumed. Statistical data on the subject of astigmatism require at least a differentiation of the standard or ommetropic eye, the flat or hypermetropic eye, and the elongated or myopic eye. It is the last form of eye abnormality which is apparently the most common.

The importance of accuracy in investigations of this kind is emphasized in the tabulated returns of defective vision in the treatise on "Medical Inspection of Schools," by Gulick and Ayres. These authors show that among Cleveland school children examined for defective vision, 20.7 per cent. were defective in the year 1900, but in 1907, in the well-to-do districts of Cleveland, 32.4 per cent. had defective vision, and in the congested districts, 71.7 per cent. According to the Massachusetts returns for 1907, 22.3 per cent. of the children had defective vision; and in New York City in 1906, 31.3 per cent. were of this class. Comparing the results for New York City in 1906 with those for Minneapolis in 1908, these authors

show that defective vision in the former amounted to 22.8 per cent., and in the latter to 23.9 per cent., but in all of these returns no clear distinction is made between visual strength and astigmatism, which, however, is absolutely essential for practical purposes.

The Massachusetts returns for 1907 give a general average of 22.3 per cent.; in one county (Suffolk) the percentage was 30.7, while in another (Plymouth) it was only 15.8. In fact, by particular towns the percentage was as low as 2.6 in the case of Halifax, while it was as high as 60 per cent. in the case of Chilmark (on Martha's Vineyard Island), where 17 out of 28 children were reported as having defective vision. It is said in the report, however, that "these differences may represent actual differences in the children, or they may be due to differences in the conditions under which the tests were made, as in poorly lighted rooms, or to differences in the skill and care with which the tests were made." In other words, the differences may be due to the utter worthlessness of some of the examinations, and perhaps of most if not of all. It is not the right kind of a contribution to educational statistics, to furnish statistical data which can be variously interpreted as of the utmost significance on the one hand, or of no significance whatever on the other.

For reasons which require no extended consideration, it may safely be expected that astigmatism and impaired visual power should increase with increasing age, or from the lower to the higher grades. It is, therefore, of importance, that statistical returns as to visual strength and astigmatism should be tabulated in this manner and not given in the form of aggregates inclusive of children from the lowest to the highest school ages. In fact, the element of age, is almost generally neglected in the statistical returns of boards of education on defective vision, and for that matter, with regard to all other physical and mental defects and infirmities.

Defective or abnormal vision is merely one of many important physical aspects of school life which have a direct relationship to school attendance. Eyestrain, unquestionably, is the underlying cause of a vast amount of ill-health, not only during youth but during middle life and even old age. Eye-

strain is responsible for many of the so-called educational failures, or backward children. What is true of defective vision is more or less true of all other physical defects, chiefly defective hearing, adenoid growths, enlarged tonsils, defective methods of breathing, defective circulation, etc. However difficult it may be to take these factors into consideration in the development of educational ideals, it would be folly to ignore them. Whether the subject is one of real economic importance in the administration of schools is secondary to the question as to whether the defective child itself can not be materially helped by the development of a rational policy of school supervision and more or less medical control. The authors of the report on medical inspection of schools are of the opinion that successful medical inspection results in indirect, and not in direct, financial economies. Considering, however, the largely unexplored field of physical and mental defects—their causes, cure, prevention, or amelioration—the accuracy of this conclusion may be seriously questioned. A school providing for full attendance and actually having an attendance of only 75 per cent. throughout the year, must obviously fall short of the fulfillment and economic realization of its purpose, even though the facts may not be statistically measurable or the results may not be indicated in dollars and cents. Personally, however, I am of the opinion that even from an economic point of view it would be possible, by means of accurate and comprehensive statistical data, to establish the close relationship between economical school administration and reasonably full school attendance. Or, in other words, I believe that it would *pay* the community to reduce absence and retardation to a minimum by intelligent medical and physical inspection of school children and to employ methods of sanitary control. Many other important questions concerning school management and its results require an answer, to which, however, at the present time, no accurate or conclusive answer can be made.

We require to know the amount of floor space per pupil as well as the amount of cubic space, for a defect in the former may not be disclosed by a statement of the latter.

We require more accurate and conclusive statistics on the

question as to whether there is a direct relationship between school attendance and epidemic outbreaks of acute infectious diseases, which are certainly but inevitably fostered by school attendance, but which, through effective sanitary supervision and immediate infection can be brought within better control than is at present the case.

We require to know more definitely the actual temperature and air conditions in school rooms during the winter months, for it is practically certain that the large majority of school rooms are overheated and badly ventilated, with resulting conditions decidedly favorable to coughs and colds.

We need better mortality statistics of children at school, thoroughly analyzed according to causes and circumstances, to determine the extent to which deaths from diphtheria, scarlet fever, and whooping cough are directly traceable to school infection.

We require a more precise distinction in school statistics between elementary, secondary, and high schools, and we also are urgently in need of more ample statistics for private schools, which are practically ignored in most of the educational reports.

Much of the foregoing information is of the greatest practical importance in that it forms the basis for an accurate knowledge of the child's life in its relation to future growth and development. The modern principles of child-labor legislation and factory hygiene emphatically suggest the utility of a correct statistical basis for measures which react powerfully upon the community, and which, unfortunately, often miscarry because of ignorance and misunderstanding concerning the fundamental principles which should underlie social legislation. It has been said, and with much truth, that the time and energy of teachers should be given to instruction rather than to the compilation of statistics. Unquestionably the teaching function should come first; but the statistical function, or the faithful recording of certain essential facts, is as much a part of a teacher's duty as similar requirements are of doctors, who, in the midst of their arduous labors, must communicate essential facts to municipal or state boards of health, or other authorities. No one whose profession or

function in life involves the discharge of public or semi-public duties can avoid the necessity of faithfully recording facts which are essential to the efficient administration of a rational system of governmental policies. It is not, however, that teachers object to the recording or collecting of useful statistical information, but that they are opposed to the making of reports which are obviously useless and which can never be made to serve a proper and legitimate governmental or public purpose. It is not so much a question of statistics, as such, as it is of statistical information of the right kind, that confronts the teacher, and there can be no doubt that whatever is legitimate, rational, and useful in the way of information concerning the pupil, will be cheerfully supplied by the large majority, who have the best interest of the child at heart.

There is little hope of a substantial reform in our educational statistics until the Bureau of Education of the United States Government is adequately and properly provided with a statistical force in conformity to the administration of educational departments abroad. Educational statistics are much more complicated and involved than vital statistics, to which the municipalities, states, and the Federal Government give such very serious attention. Certainly the children, who are properly called "the best asset of the Nation," are entitled to the fullest consideration in this respect, and there is little doubt but that, if once the importance of the subject is fully realized, the United States will take a position in this respect which will place it fully on a par with other truly civilized nations of the earth.

SOME RECENT DEVELOPMENTS OF SCHOOL STATISTICS.*

By Roland P. Falkner, *Assistant Director of the Census.*

Despite the fact that the system of public schools is deemed to be one of the fundamental bases of our national life, and that it absorbs for its maintenance a large share of the revenue raised by taxation, the American Statistical Association has hitherto given but scant attention to the statistical questions arising in this field of public adminstration. It is the purpose of the present paper to review some recent developments in the statistics of public schools, which have lifted these statistics out of perfunctory routine, have awakened the interest of progressive schoolmen, and which, in the writer's opinion, merit the attention of all who are interested in the application of statistical methods to problems of research and administration.

Save in isolated cases in individual cities, the problems of the common schools had, until recent years, neither attracted the attention of men trained in statistics, nor developed any especial statistical acumen among those charged administratively with the duty of preparing such figures for school reports. School reports, school journals, and the proceedings of educational bodies bear witness, especially in the last five years, to a new appreciation of the value of school statistics, though it would be difficult to trace it back to its origins.

The unit of presentation for facts concerning the schools is the school district, large or small as the case may be. To determine exactly where and when some special form of presenting the facts first appeared would be a matter of much research, with a result that would have rather a curious than a practical interest. For a broad general outline of recent developments, innovations are significant only when they have attracted more than local attention. This depends not so much upon the inherent value of any new method of presenting facts as upon the influence of those who adopt it.

* Paper presented at the quarterly meeting of the American Statistical Association, Cosmos Club, Washington, D. C., April 14, 1911.

Of the most extensive influence in such matters is naturally the United States Bureau of Education. Then follow the several state bureaus, and the school systems of the larger cities. Initiative may, and often does, proceed from smaller cities, but it is only as it is recognized or adopted by the larger units that its influence reaches wider fields. The United States Bureau of Education, inadequately equipped even for its present duties, can only collect such statistics as the various school units may be willing to furnish. Until recently it has not attempted to go beyond a few simple facts of school enrollment, attendance, and expenditure. In the effort which has hitherto been its leading endeavor to present complete school statistics of all school districts in the United States it could not go very far into details. It has collected, in other words, mainly what was readily available, and apart from the standpoint of geographical distribution the material has not been especially significant. Of late years, the Bureau has, in addition to maintaining its general tables, been able to specialize, drawing more largely than before upon the willingness of school authorities to furnish information, and presenting in special studies more detailed facts for restricted areas.

Most of the state bureaus are even more inadequately equipped than the national bureau, and, like it, collect information on traditional lines. Some of them, however, are in a position to prescribe schedules, and possessing this power have developed a more fruitful activity. On the other hand, the heads of city systems have it absolutely in their power to collect and publish such figures as they deem proper, and use this power to a greater or less extent. The influence of the school report, however excellent, is largely local, except as the example of New York and other large cities may attract wider attention. In a general way, moreover, it is true that the larger the school system the greater is the elaboration given to the statistical showings. There are, of course, large cities woefully deficient in this respect as well as some smaller systems which excel in statistical presentations.*

The reports of the United States Bureau of Education before 1904 reflected the general status of school statistics through-

* Snedden (D. S.) and Allen (W. H.) School Reports and School Efficiency, 1908. Falkner "What Can and Do School Reports Show," *Psychological Clinic*, March, 1910.

out the country and the general interest in such figures. Information was given as to certain features of financial management; receipts, distinguishing between state, city, and county taxes or appropriations; and expenditures in four items, namely, permanent investment, teaching and supervision, current and incidental, and evening schools. The number of school buildings, their seating capacity, and the value of school property are also noted. That these figures are capable of considerable development, and that the cost of running the schools could be subdivided in many ways so as to bring out the cost of particular services is obvious. The Bureau of the Census, in co-operation with the Bureau of Education, has prepared a special schedule for the expenditures of city school systems which will give more detailed and more directly comparable information with especial relation to the different types of schools constituting the system. But this is a story by itself which can not be treated at length in this paper. Our present concern is particularly with the pupils of the schools. Regarding the latter, the following information was available in earlier reports of the national bureau: the total number of children enrolled in the schools, boys and girls being separately stated; and the annual average attendance.

The fundamental view of the general statistics of the Bureau of Education is to show how much of the public money is spent for schools and how many persons are the beneficiaries of the expenditure. If the question were raised whether the money was well spent the answer usually took the form of comparisons of per capita expenditures, rather than of any test of the efficiency of the school system. The recent developments which form the subject of this paper have grown out of the inquiry how far the school system as a whole is accomplishing the task it undertakes. This inquiry has led to the specific questions: how many children secure a common school education, how many fall short of it and why—problems which current discussion designates as those of survival, elimination, and retardation.

The first of these interests is that of survival and the first step towards an appreciation of its significance was a study of the number of pupils in each grade of the elementary schools. So simple a detail of school work as this has only recently

been a common feature of school reports. Tables relative to grades in the schools first appeared in the Report of the Bureau of Education for 1898, when data covering twenty-four cities were assembled. No further note of grade numbers occurs until the report of 1903, which gives an account of the Bureau's exhibit at St. Louis. Based, so far as any evidence is presented, wholly upon estimates and not upon any original enumeration, the Bureau showed charts giving the grades of pupils of the United States, their ages, and the average age of entering the work of each grade.

The following report of the Bureau, for 1904, stimulated by the example of Superintendent Maxwell, of New York, gives more attention to the grades and to the ages within the grades. From the reports of fifty-eight cities, it assembles figures in regard to the numbers in each grade of the elementary schools. Two years later, in 1906, similar information is available in 127 cities. Up to this time, the information published by the Bureau was gathered from an examination of the school reports. In 1906–1907 the question was asked as a part of the regular schedule of the Bureau and replies were received from 752 cities and villages. Since then it has been a constant feature in the reports of the Bureau, though the reports have as yet refrained from any analysis of them, basing this on the dissimilarity of the data, which is sometimes reported on total enrollment, sometimes on the average enrollment, or by average attendance, or by other methods. Summarized, the development of the material is as follows:

School Year.	Cities.	Cities and villages.
1898	24	
1904	58	
1906	127	
1907	386	762
1908	532	1,040
1909	536	1,024

The development of the material is not without interest, but greater importance attaches to the interpretation of it. A typical distribution by grades is the following: giving the figures for Philadelphia in 1908:

Grades.	Numbers.	
	Absolute.	Relative for 1,000 in first grade.
First	26,741	1,000
Second	22,858	850
Third	21,858	817
Fourth	18,543	693
Fifth	15,001	561
Sixth	11,927	446
Seventh	7,860	294
Eighth	6,203	232

The instinctive interpretation of these figures is that as the eighth grade is only 23.2 per cent. of the number of the first grade that only 23.2 per cent. of the pupils entering the school reach the eighth grade. Such a conclusion is frequently drawn from figures of this sort, although the fallacies of such a conclusion have been carefully pointed out by authorities on school statistics.* This crude interpretation of the grade figures has two underlying assumptions, neither of which is correct:

a. That an equal number of children enter school annually, and that therefore the present eighth grade pupils are survivors of a class as large as the present first grade, which would be true only of a stationary population.

b. That all pupils stay only one year in a grade, and that therefore the first grade numbers are equal to the number who enter each year.

In his report for 1908, the State Superintendent of New York, Dr. A. S. Draper, presents a study of industrial education, in which he quotes the grade figures. He recognizes the first difficulty, and therefore compares the eighth grade of 1906 with the first grade of eight years earlier. His figures embrace twenty-five cities in New York State outside of the City of New York. The totals for these cities are given as follows:

*Ayres (Leonard P.) "Laggards in Our Schools," New York, 1909. See especially Chapter III, Some Factors in Grade Distribution.

Grade.	Number of Pupils.	Per cent. of First Grade.
First	21,410	100
Second	17,524	82
Third	17,028	79
Fourth	15,918	74
Fifth	14,395	67
Sixth	12,464	58
Seventh	10,152	47
Eighth	8,517	40

Doctor Draper's comments on these tables show that he has failed to recognize the second difficulty. With the utmost frankness he says:

"Reflections upon this subject have led me to seek exact information, and I confess, with some humiliation, that it surprises me. The situation is even worse than I supposed. I have assumed that practically all the children who do not go to the high schools do finish the elementary schools. That is not the fact. It is clear that the larger number do not finish the elementary schools by the time they are fourteen, the age at which the law says they may leave school to go to work, and that this provision of the law very commonly leads parents to think that the time has come for them to go to work, notwithstanding the fact that they have not finished the lower schools, and notwithstanding the other fact that there is little remunerative work which they can do. There is often more of a break in attendance between the fifth and sixth grades of the elementary schools than there is between the elementary schools and the secondary schools." . . .

His statement is summarized in the following figures:

"I confess that it startles me to find that certainly not more than two fifths and perhaps not more than one third of the children who enter our elementary schools ever finish them, and that one half of them go beyond the fifth or sixth grade." *

It may be incidentally remarked that this statement shows that after all survival and elimination are only two aspects of the same problem, that of children leaving school at various stages throughout the school course.

* State of New York, Fourth Annual Report of the Education Department, 1907, p. 579 *et seq.* Falkner, Elimination of Pupils from School, *Psychological Clinic*, February, 1909.

The next important contribution to the subject was a pamphlet on "Elimination of Pupils from Schools," prepared by Prof. E. L. Thorndike, and published by the United States Bureau of Education in 1908. Professor Thorndike assembles data from twenty-three cities and comes to the following conclusion:

"(1) At least 25 out of 100 children of the white population of our country who enter school stay only long enough to learn to read simple English, write such words as they commonly use, and perform the four operations for integers without serious errors. A fifth of the children (white) entering city schools stay only to the fifth grade."

This conclusion is predicated on a table which shows for each city Doctor Thorndike's estimate of the percentage of pupils entering school who continue to the fourth and successive grades. The summary results are presented in the form of medians as follows:

Fourth Grade	90 per cent.
Fifth Grade	81 per cent.
Sixth Grade	68 per cent.
Seventh Grade	54 per cent.
Eighth Grade	40 per cent.

These conclusions, not so much in their general tenor as in the figures published for individual cities, raised a storm of protest. Dr. A. E. Winship, the editor of the *Journal of Education*, who can, upon occasion, turn his pen into a bludgeon, delivered some smashing blows at what he deemed to be Professor Thorndike's methods and held up the alleged results to ridicule.* The criticism was not conclusive because in fact the methods followed by Professor Thorndike in his bulletin are not fully disclosed. He informs us there that the process of estimating how many of the pupils who enter school reach a given grade is a task of much intricacy, and that his estimates involve several "corrections" of the original grade figures. But he adds: "It would be unprofitable to anyone except the critical student of statistical problems for me to rehearse the details of this tedious process of corrections." The vigorous attack of the *Journal of Education* was met with an equally staunch defense and Doctor Thorndike was able,

* *Journal of Education*, April 16, and May 21, 1908.

by reason of his elusive statement as to the methods which he had followed, to point out triumphantly that the critic had not understood him.*

The *Journal of Education* attacked Professor Thorndike's work at its weakest point. It directed attention not to the final result for the eighth grade but to the alleged loss in the first three grades, and combated the figures cited by the general experience of school authorities. That ten per cent. leave before reaching the fourth grade on the average, and that in New England cities such as Boston and Malden, the proportion is about fifteen per cent. is simply not in accord with fact. The objection is, and it is substantially correct, that no children leave school before reaching fourteen years of age, and that there are no children of this age in the first three grades. If then the estimates give too few survivors in the early grades, the proportions in the upper grades must be too small also.

Doctor Winship saw clearly that Professor Thorndike estimated the number of beginners too high, and believes that he has found the source of the error in the fact that the average of the first three grades is taken as the number of beginners. Doctor Winship says why count the first grade at all, even as a part of an average. Doctor Thorndike replies, in substance, that he does not take the average of the first three grades as the number of beginners, but only appears to do so.

In a more extended criticism of Professor Thorndike's methods and results, I have pointed out that wherever he makes a positive statement of how he secured the number of beginners, it can readily be demonstrated that his figures are too large.† It is pointed out, not only that large numbers of pupils repeat the early grades, but that the estimated number of beginners, according to Thorndike, is considerably larger than the successive generations of pupils who enter the schools. It is there suggested that since all children enter school but once, the number of a generation in the public schools is the best test of the number of beginners.

Later, Doctor Ayres applies this suggestion in his book

* *Journal of Education*, May 21, 1908.

† Falkner, Elimination of Pupils from Schools; A Review of Recent Investigations, *Psychological Clinic* February, 1909.

already cited. He uses the average of the ages 7 to 12 as the approximate number of beginners and compares his results with those of Doctor Thorndike. For the final elementary grade, we find the following:

PER CENT. CONTINUING TO FINAL GRADE IN 16 CITIES.

	Thorndike.	Ayres.
Lowest	14.4	28.0
Highest	49.4	68.8
Medium	33.3	48.6

The significance of this critical review lies in the fact that the study of grades can not reach correct conclusion without a concurrent study of ages in the grades. Using technical terms, becoming more and more familiar among schoolmen, elimination can not be understood without a reference to retardation.

Let us understand exactly what we mean by retardation before attempting to show the steps by which its discussion has come into prominence in recent years. That retardation of school children in general terms expresses a misrelation between the age of the children, and the grades appropriate to their age is more and more a generally accepted proposition. A table showing the age of the pupils in each grade is the accepted source of information. It is assumed that for each grade, there is a normal age and that pupils who are beyond this age are retarded or behind in their work. From a technical point of view it may be looked upon as the most effective and instructive condensation of a table of ages and grades. The accompanying table for Philadelphia makes this clear.

A cursory examination of the table by grades shows that pupils of the first grade range from 5 to 16 years of age. Similarly it will be seen that eleven-year-old pupils are in all the grades from first to eighth. Of the multitude of facts in this table, the last three lines give a concise expression. Heavy lines in each column separate in each grade the pupils of normal age or under, above the line, from those above normal age who are below the line. The latter added together are then compared with the total number of pupils. The last line shows us that, in Philadelphia, 42.2 per cent. are retarded, and that from 21.1 per cent. in the first grade, the

proportion rises to 55.3 per cent. in the fourth grade, and then declines to 36 per cent. in the eighth. This rise and fall is repeated wherever observations have been made.

GRADES AND AGES OF PUPILS ATTENDING PHILADELPHIA SCHOOLS, DECEMBER 15, 1908.

Ages in Years.	Elementary Schools—Grades.								
	1	2	3	4	5	6	7	8	Total.
Under 5	5	.....	.....	.....	.....	.....	.....	.....	5
5	1,000	.....	.....	.....	.....	.....	.....	.....	1,000
6	11,841	255	1	1	.....	.....	.....	.....	12,098
7	8,244	5,641	330	3	.....	.....	.....	.....	14,218
8	3,528	7,635	4,518	312	1	.....	.....	.....	15,994
9	1,137	4,510	5,929	3,186	257	6	.....	1	15,026
10	503	2,463	5,013	4,778	2,660	247	5	.....	15,669
11	250	1,123	3,044	4,352	3,929	2,191	258	12	15,159
12	143	663	1,853	3,335	3,906	3,538	1,924	219	15,581
13	63	323	902	1,933	2,950	3,476	2,681	1,619	13,947
14	19	101	223	541	1,022	1,754	1,953	2,117	7,730
15	6	12	40	90	225	552	795	1,470	3,190
16	2	.....	5	10	46	133	212	582	990
17	.....	1	.....	1	3	25	39	145	214
18	.....	1	.....	.....	2	5	2	32	42
19	.....	.....	.....	.....	.....	.....	.....	5	5
20	.....	1	.....	1	.....	.....	.....	1	3
Total	26,741	22,729	21,858	18,543	15,001	11,927	7,869	6,203	130,871
Over age	5,651	9,198	11,080	10,263	8,154	5,945	3,001	2,235	55,527
Per cent. over age	*21.1*	*40.4*	*50.6*	*55.3*	*54.3*	*49.0*	*38.1*	*36.0*	*42.4*

The development of an interest in retardation proceeded from two points widely separated geographically—New York City and Porto Rico—but through the return to the United States of Porto Rican officials, the two movements have been merged into one. In his report for 1904, the Superintendent of Schools in New York, Dr. W. H. Maxwell, developed the idea of the over-age or retarded pupil, and showed by his figures that some 39 per cent. of the pupils in the public schools were retarded. At the time his work stood practically alone. There was nothing to compare it with. Whether the percentage was high or low could not be known by a comparison with other places. It was, however, recognized by Doctor Maxwell that retardation was not a phenomena peculiar to New York schools, and he was interested in ascertaining the factors which produce retardation more than in measuring its

amount. In the discussion which followed the publication of these facts, attention was frequently called to the defective physical condition of school children as determined by the medical inspection of schools. The conclusion was frequently drawn that physical defect was the main cause of backwardness, and Doctor Maxwell's studies exerted a stimulating influence upon the ever-spreading movement for medical inspection.

In its report for 1904, the Bureau of Education applies the concept of a normal age to other figures giving the age and grade distribution of pupils found in the reports of other cities. The whole number of cities in the list, including New York City itself, is only nine, and this represents presumably the information available at that time.

In the school year 1905–1906, the Department of Education of Porto Rico, then under my charge, undertook a complete reorganization of its statistical service. Information was gathered and presented regarding the age of pupils, the grades, the ages within the grades, the length of time in schools, the duration of enrollment, and other matters. In interpreting the figures thus gathered in Porto Rico, the effort of the Department was to show how far conditions found in the Island were normal as compared with the United States. A search through the available material showed me that comparable figures could rarely be obtained, that there was, at that time, no commonly accepted form of a grade distribution, or of an age distribution of the pupils in the elementary schools. But these studies brought to our attention the figures regarding the normal age as published in the report of the Bureau of Education before cited, and led to the application of this concept to the figures for Porto Rico. So far as we were able to determine statistically the causes of retardation, we were able to point out certain relations between retardation and irregularity of attendance, and, in general, our thought went in the direction of explaining the phenomena by certain facts of school life rather than attributing it to the mental or physical condition of the pupils concerned. In the statistical work of my department I was assisted by Dr. Leonard P. Ayres, who entered into the reorganization of the statistics with great intelligence and enthusiasm, and who developed, even

at that time, a keen appreciation of the educational and statistical problems involved in the discussion. The work of the year 1906 was continued with more elaboration in the following year.

In 1907, Dr. Luther H. Gulick, of New York City, became much interested in the line of work which had been done in Porto Rico and the attitude which was expressed by Doctor Ayres and myself, that the main causes of retardation were not to be sought in the questions of the physical condition of school children. He interested at once the school authorities of New York, and the authorities of the Russell Sage Foundation, with the result that the latter body made an appropriation for an investigation of backward children and placed Doctor Ayres in charge. The primary object of this investigation was to ascertain directly the relation of retardation to physical defects and it was proposed, by concurrent examination of the records of medical inspection and of age and school standing, to determine how far physical defects contributed to the number of backward children. This investigation covered nearly 10,000 cases in selected schools in the Borough of Manhattan. A report on this investigation was submitted to the superintendent of schools and appeared in his annual report for 1908.

While this special investigation of New York City was going on, it was determined to select from the school reports all the data bearing upon retardation, and a very thorough search was made through the school reports of the one hundred largest cities for a period of ten years. The original intention was to combine these figures in a volume on the data of retardation which should be separate from the report on the New York City schools. The matters, however, were so intimately related and the figures for other cities threw so much light on the general situation that both lines of inquiry were finally combined in the work of Doctor Ayres, 1909, published by the Russell Sage Foundation, entitled "Laggards in Our Schools; A Study of Elimination and Retardation in the City School Systems." The example of Doctor Maxwell bore fruit elsewhere. Supt. James E. Bryan, of Camden, applied, in 1906, the same methods to the pupils of schools and carried them a few steps in advance. Interest in mentally backward chil-

dren had received in Philadelphia a new impetus from the study of such children by Prof. Lightner Witmer, of the University of Pennsylvania, and the experimental work in the psychological clinic which he established, and the records of its work in the journal of the same name which he founded.* Doctor Witmer has offered in this journal an opportunity for the statistical as well as the psychological study of retardation, and has published a series of articles by Doctor Bryan; Dr. Oliver P. Cornman, associate superintendent of schools in Philadelphia; Doctor Ayres, and others.† It is significant of the increased interest in the matter that while, in 1904, the Bureau of Education could assemble figures showing the per cent. of retardation from nine cities only, Doctor Ayres, in 1909, gives us a list of thirty-one cities, showing a range of retardation from 7.5 per cent. of pupils in Medford, Massachusetts, to 75.8 per cent. of the colored pupils in Memphis, Tennessee. As the school reports of the various cities have come under my observation for the past two years, the prominent fact is the increase of interest in this matter and the growing volume of material which is available in the school reports.

Stimulated by these discussions, the United States Bureau of Education, in December, 1908, made a special inquiry as to the ages of the pupils attending each grade on a certain date. The results of this inquiry, embracing 318 cities, have not been published. The significance of the inquiry depends not only upon the large number of places involved, but more especially upon the uniformity in collecting the material which, for the first time, will give us directly comparable data for the different cities involved. As has already been pointed out the matter published in the city reports is, from a statistical point of view, quite varied. Some figures relate to the total enrollment during the year, others to the enrollment on a given date, sometimes early in the school year and sometimes late. It would take too long to explain how these differences

* *The Psychological Clinic;* edited by Lightner Witmer, Ph. D., Vol. I, March, 1907, to date.

† Bryan, J. E., A Method for Determining the Extent and Causes of Retardation in a City School System, *Psychological Clinic*, April, 1907.

Cornman, The Retardation of the Pupils of Five City School Systems, *Ibid*, February, 1908.

Falkner, Some Further Considerations upon the Retardation of the Pupils of Five City School Systems, *Ibid*, May, 1908. (In this review of Doctor Cornman's essay, I devote considerable attention to the diversity of the materials which he uses, and call attention to the problems of statistical methods which are raised in this diversity. Several chapters of Doctor Ayres' work, "Laggards in Our Schools," appeared as essays in this periodical.)

vitiate the comparisons, but a single illustration will indicate the possibilities in the case. The city of Boston makes up one report in January and another report in July. If we figure the percentage of retardation on the July basis, it is always greater than if figured on the January basis, for the simple reason that the children are older at the end of the school year than they are in the beginning of it.*

It is clear that the unknown difficulties arising from different methods of enumeration will be entirely eliminated in the reports which have been gathered directly by the United States Bureau of Education.

With the publication of the reports gathered by the Bureau of Education we shall have ascertained with considerable accuracy the measure of retardation in different places. The cause of retardation is, obviously, of quite as much interest as its measure. Various attempts have been made, in a speculative way, to assign the causes of retardation. The following have been suggested by various writers: (1) The foreign element in the population; (2) Age at starting school; (3) Irregular attendance; (4) Transfers; (5) Physical defects; and (6) Mental defects.

It can not be said that general discussion has thrown much light upon the significance of these alleged causes. The argument has too often been that a large percentage of the children are of foreign origin and that a large percentage of school children are retarded, and that, therefore, the principal cause of retardation is the foreign element, or that a large percentage of children are retarded and a large percentage are physically defective, and therefore physical defect is the principal cause of retardation. We shall concern ourselves briefly with attempts which have been made to measure, at least approximately, the force of these several causes.

One method of examining into the causes of retardation which naturally suggests itself is to secure the direct information from the teacher as to the causes in each individual case. This was attempted by Superintendent Bryan in Camden in 1906. In order to get comparable results, he found it necessary, after a tentative examination, to make up the sched-

*Falkner, "Further Consideration," etc., *Psychological Clinic*, Vol. II, p. 65.

ule of main causes, to drill the teachers to an exact understanding of precisely what was meant by each category, and to consider that where two causes co-operated in the result that only one, which might be deemed the principal one, should be reported. The results of this inquiry are interesting. They are:

(1) Percentage of excessive age due to age on entering school, 21.2 per cent. of all retarded pupils.
(2) Absence, 28.5 per cent.
(3) Slowness, 21 per cent.
(4) Dullness, 12 per cent.
(5) Poor health, 9.6 per cent.
(6) Physical defects, 3.96 per cent.
(7) Mental defects, 3.7 per cent.

It will be noted that this table gives no reference to the foreign element of the population since, as a result of a preliminary examination, Superintendent Bryan reached the conclusion that this was not an important factor in causing retardation. The method employed by Superintendent Bryan is only applicable under peculiar conditions and most attempts to examine into the relationship of other causes to the amount of retardation have assumed different forms.

The Foreign Element: Not because it is of first importance, but because it has given rise to an important investigation, which should be mentioned in this connection, the foreign element may be considered first. When the United States Immigration Commission was constituted it was proposed to include in its scope of work an investigation of the children of immigrants in the schools. This inquiry was intrusted to the writer. The first step was to secure information concerning the ages in the several grades, distinguished by nationality. This was done in December, 1908, in thirty-seven cities. The results of this inquiry have been tabulated but have not yet been printed. A preliminary abstract, issued by the Immigration Commission, gives us some interesting results. It is not proposed here to survey the entire inquiry, but only to draw upon that part of it which concerns retardation. The general results of this inquiry are given in the following table:

ALL ELEMENTARY SCHOOL PUPILS.

General nativity and race of father of pupil.	Total.	Retarded.	
		Numbers.	Per cent.
Native born:			
White	618.212	210.959	34.1
Negro	44.215	28.092	63.5
Total	663.735	239.661	36.1
Foreign born:			
Bohemian and Moravian	27.775	9.303	33.5
Canadian, French	8.744	3.771	43.1
Canadian, other	26.937	7.523	27.9
Danish	6.265	1.955	31.2
Dutch	3.306	1.028	31.1
English	50.611	17.061	33.7
Finnish	1.356	.375	27.7
French	7.630	3.374	44.2
German	190.340	66.892	35.1
Hebrew German	33.054	9.873	29.9
Hebrew Polish	20.499	7.475	36.5
Hebrew Roumanian	12.673	4.423	34.9
Hebrew Russian	173.849	60.482	34.8
Irish	77.135	27.046	35.1
Italian North	29.156	13.395	45.9
Italian South	70.602	34.281	48.6
Lithuanian	3.376	1.293	38.3
Magyar	5.140	1.816	35.3
Norwegian	16.675	5.656	33.9
Polish	21.695	10.426	48.1
Portuguese	4.657	2.094	45.0
Russian	4.124	1.458	35.4
Scotch	15.657	5.157	32.9
Slavak	3.209	1.292	40.3
Swedish	42.084	12.069	28.7
Welsh	2.986	.957	32.0
Total foreign born*	939.774	338.424	36.1
Grand total	1,603.509	578.085	36.1

* The total includes also representatives of other races not named in the foregoing list.

The comparison of the native white and foreign white element as represented in the percentage of pupils shows very slight differences in the aggregate. The analysis of the foreign white element shows considerable diversity among the races represented in the table. The children of fathers from the British Isles, except Ireland, and from the Scandinavian countries show less retardation than the native white. The same is true of the Bohemian, the Canadian other than French, the Dutch, and the Finnish groups. All others have greater retardation which is most marked in the case of the Italian, Polish, and Portuguese groups.

The differences in the several races suggest that the composition of the foreign parentage group has much to do with the total result. In a further investigation on the more extensive

plan of a separate schedule with a great deal of detail for each pupil, records of upwards of 60,000 pupils in other cities and in selected schools in some of the larger cities were examined and tabulated. The main results of this tabulation, which however includes only those pupils who had attained the age of eight years and upward, are as follows:

ELEMENTARY SCHOOL PUPILS, 8 YEARS OF AGE AND OVER.

Parentage and Nativity.	Number.	Retarded.	
		Number.	Per cent.
Pupils of native-born parents:			
White	16,881	4,748	28.1
Negro	1,000	668	66.8
Indian	23	11	47.8
Total native born	17,904	5,427	30.3
Pupils of foreign-born parents:			
English speaking races	5,295	1,448	27.3
Non-English speaking races	23,637	10,252	43.4
Total foreign born	28,932	11,700	40.4
Grand total	46,836	17,127	36.6
Included among pupils of foreign parents:			
German	4,137	1,359	32.8
Hebrew Russian	5,484	2,295	41.8
South Italian	2,978	1,894	63.6
Pupils of all races who were themselves born abroad	6,761	4,169	61.7

In this table there is a wide divergence between the percentage of retardation for the native white group and for the foreign white. The cause of this greater divergence is seen in the analysis of the latter group. The children of immigrant fathers, who spoke English as their mother tongue, is about the same as for the children of native white parents. The divergence is found among children of immigrant fathers who did not speak English as a mother tongue, and this group is relatively large. Because it is large the proportion of children born abroad is relatively large also. Such children as the table shows, have considerably more than half their number in the retarded class.

The abstract prints special tables which give more data in regard to three of the important races. The figures follow:

PERCENTAGE OF PUPILS, 8 YEARS OF AGE AND OVER, WITH FOREIGN-BORN PARENTS, WHO ARE RETARDED.

	German.	Hebrew Russian.	South Italian.
Pupils whose fathers speak English	31.7	34.9	59.2
Pupils whose fathers do not speak English	40.6	66.6	72.7
Pupils whose fathers are naturalized or have first papers	31.6	36.4	82.1
Pupils whose fathers are aliens	42.6	59.4	71.2
Pupils whose fathers have been under 5 years in the United States	67.4	74.6	82.1
Pupils whose fathers have been 5–9 years in the United States	41.9	57.2	75.2
Pupils whose fathers have been 10–19 years in the United States	33.4	31.9	61.6
Pupils whose fathers have been 20 years or more in the United States	31.1	29.7	55.4

This percentage table shows that the proportion of retarded children is greater among those of Hebrew-Russian parents than of German parents, and still greater among those of South Italian parents. It shows greater retardation in each case where the father does not speak English, and where the father is an alien. The proportion of retarded children diminishes also with the length of time the parents have been in the United States. Here the comparison of the German and the Hebrew-Russian is particularly instructive. It appears that with longer residence in the United States, the latter make the better showing. If, in the aggregate, the Hebrew-Russian rank below the German it is because a larger proportion of the fathers have been less than ten years in this country and because a larger proportion of the children were themselves born abroad.

Late Entrance: Much more important as a cause of retardation, as it has been defined in this paper, is the fact that certain children begin their schooling relatively late in life. By the terms of our definition, an eight-year-old child in the first grade is retarded. Some children do not begin school until they are eight years of age, and in but a few places does the law compel them to do so. Some critics have raised the question whether such a child ought to be considered retarded if he then proceeds through the grades without interruption.* The defense of the common usage is, that retardation represents a state of facts and is not concerned with the process by which that state of facts arose; that whether a child is older

*Greenwood, (J. M.) Miring in the Grades and the Promotion of Pupils, *Educational Review*, Sept., 1908; and Falkner, Retardation: Its Significance and Its Measurement, *Ibid*, Sept., 1909.

than the normal age of his grade because he enters late, or entering early, because he fails to progress, he is at any given time retarded with respect to his fellows of the same age.

It is a mistake to suppose that many children enter school late. An examination of our age figures for Philadelphia shows very little difference between the number reported at seven years of age and that reported at eight years of age. Materials gathered by the Immigration Commission on the age of entering school are unfortunately not as yet available.

The inquiry of Doctor Ayres in New York City touched directly upon this question. He reaches the following conclusions: That of one hundred retarded children, thirty are retarded because of late entrance; thirteen because of a combination of late entrance and of slow progress; and fifty-seven because of slow progress only.

Transfers: Another cause of retardation is the fact that children lose time when they change schools. On this point the Immigration Commission gathered evidence in regard to the shifting of population and change of schools. The percentage figures from the abstract for the native group are:

PERCENTAGE OF PUPILS OF NATIVE FATHERS, 8 YEARS OF AGE AND OVER, WHO ARE RETARDED.

Pupils born in city of enumeration	26.7
Pupils born elsewhere in the United States	31.6
Pupils born elsewhere who had attended school elsewhere	35.0
Pupils born elsewhere who had not attended school elsewhere	27.3
Pupils entering present grade by promotion	22.9
Pupils entering present grade by transfer	37.9
Pupils entering present grade by non-promotion	58.8

Children born in the city where they are now attending school have somewhat less retardation than those born elsewhere. Among the latter are many, no doubt, who were brought to the city before they reached the school age and whose schooling has not been interrupted. If we divided them accordingly as they have attended school in other cities or not we find that the former group has the largest retardation. This evidence of the effect of transfers was supplemented by an inquiry as to how the pupils reached their present grade. It appears that those entering by transfer from the other schools are more retarded than those who came there by promotion.

Irregular Attendance: The divergence between the total enrollment of schools and the average attendance is familiar to schoolmen, though the reasons for the divergence have never been thoroughly analyzed. In some cities, we know not only the average attendance, but the number of days attended by the different pupils. From these figures Doctor Ayres draws the conclusion that such figures as are available indicate that in our cities less than three fourths of our children continue in attendance for less than three fourths of a year. In a very few cases, we have numerical evidence of the obvious fact that this affects promotions, and can readily see how this would bring about retardation among the pupils. He has established an interesting parallelism between the percentage of defective attendance and the percentage of retardation in a number of cities.*

More direct evidence on this point was gathered by the Immigration Commission and resulted in showing that among those pupils who, during the past year, had attended three fourths of the school days the percentage of the retarded pupils was 26 per cent., while the pupils who had attended for a less period the percentage was 44.0 per cent. The significance of these figures will be appreciated when it is remembered that the attendance is not being compared with the promotions at the end of the term. They show present status and the attendance of the period under consideration is considered as typical of the attendance of pupils throughout their school career.

Physical Defects: That there is a relation between school progress and physical defect, in some cases, is obvious. That the child of defective hearing is handicapped needs no explanation; that the child of defective vision suffers, at least until the defect is corrected by glasses, is also obvious. On the other hand, the only investigation which has directly correlated physical defect and school progress fails completely to show that physical defects are a predominant cause of retardation in the schools. The reason for this is that we lack definitions for physical defects which are in direct relation to school work.† For instance, except in rare cases, such minor physical ailments as defective teeth have little to do with the

* Ayres, L. P., "Laggards in Our Schools," pp. 132–140.
† Ayres, L. P., "Laggards in Our Schools," pp. 117–131.

mental activity, and it might be said that certain physical defects contribute to mental activity by restricting the physical activity of the child. There is no reason on earth why a lame boy should not be a good student. The definitions of physical defects have been made by the doctors, and they have been made with reference to the perfect human being. Taken in the absolute sense, there are few of us who are without physical defects and yet we are not handicapped in the race for life. The conclusions of Doctor Ayres' investigations on this topic are extremely interesting, but lack of space precludes even a summary here. It would seem that a direct correlation between physical defects and school progress must await a standardizing of terms and definitions which is conspicuously lacking in the reports of the medical inspection.

This rapid summary of what has thus far been accomplished in the investigation of retardation shows it to be the result of many factors working concurrently. These may be broadly stated as being of four classes:

(1) Factors arising from social conditions in the country;

(2) Factors growing out of the physical and mental characteristics of pupils;

(3) Factors growing out of the school habits of children; and

(4) Factors arising from methods of school administration.

This division shows that the problem with which we are dealing is a general problem and that the amount of retardation is not necessarily a reflection upon the school system of a given community. It does show, however, a considerable amount of waste in school work, and the study of the question, so far as it has gone, has greatly stimulated the investigation as to what are the causes and what are the remedies. This investigation has already had fruitful results in school administration, leading, as it has done, to a more thorough study of such questions as transfers, promotions, whole-year and half-year grades, and similar adjustments of the school systems to the needs of the children.

In this brief review, it has been possible merely to indicate certain general lines of inquiry rather than to describe the detailed statistical problems which arise concerning them.

It has, I trust, been made clear in the course of the treatment, that a full answer to the questions involved means a considerable extension of the statistical data commonly collected in regard to schools. From the consideration of the grades, we passed to the question of ages and to the ages within the grades. In the examination of causes, we touched upon several factors capable of statistical elucidation; the nationality and race of pupils; the ages of pupils with reference to beginning school; the number of transfers from one school to another the degree of attendance by classes; and perhaps the physical defects of children. Each of these is capable of considerable elaboration and is receiving it in different centers. It has not been our purpose to exhibit these efforts in detail but to dwell upon the general lines of these recent developments and to show the underlying causes which have stimulated recent activity in statistical discussion and practice.

The need of further details for administrative purposes is more and more recognized,* and the practical method of securing the information needed is receiving attention. Progressive schoolmen have now come to look upon their schools as having a definite object, namely, the carrying forward of the greatest number of pupils to the most advanced point possible, and they are testing their schools with this in view. It is not unlikely that these purposes will lead to fundamental changes in the record-keeping of schools and the assembling of data concerning schools. In various cities the general register has given place to the individual card and the thought has been expressed that a card-record could be devised which would follow the pupil throughout his school career; whether it is in one school or several, or whether it is in one city or two, and that by means of such records far more accurate results could be obtained than under those which are at present current. To go back to the earlier observation, I should state in conclusion that, in my opinion, the characteristic point in the recent developments of school statistics, which have been briefly and inadequately sketched in this paper, is the tendency to establish methods which shall test the actual efficiency of the school work.

*Falkner, "Some Uses of Statistics in the Supervision of Schools," *Psychological Clinic*, January, 1909.

WOMAN AND CHILD WORKERS IN COTTON MILLS.

By Walter B. Palmer.

An act of Congress, approved January 29, 1907, provided: "That the Secretary of Commerce and Labor be, and he is hereby, authorized and directed to investigate and report on the industrial, social, moral, educational, and physical condition of woman and child workers in the United States wherever employed, with special reference to their age, hours of labor, term of employment, health, illiteracy, sanitary and other conditions surrounding their occupation, and the means employed for the protection of their health, person, and morals." For this purpose a special appropriation of $150,000 was made in 1907 and an equal amount in 1908.

The investigation was conducted by the Commissioner of Labor, Dr. Charles P. Neill. His report is to appear in nineteen volumes, of which four, relating to cotton textiles, silk textiles, glass making and clothing making, have already been published. The first volume, which relates to cotton manufacturing, was published in December, 1910, as Senate Document No. 645, Sixty-first Congress, second Session. It is a book of 1,044 pages.

The investigation of the employment of women and children in cotton mills was carried on in four of the New England and in six Southern States. The field work by agents of the Bureau of Labor was begun in the South late in the fall of 1907 and was continued there until the spring of 1908. In New England, it was conducted during the spring and early summer of 1908. The number of cotton mills investigated was one hundred ninety-eight, and their locations were as follows: Maine 7, New Hampshire 7, Massachusetts 22, Rhode Island 10, Virginia 4, North Carolina 59, South Carolina 36, Georgia 31, Alabama 13, Mississippi 9. In 1908, these ten states had 23,992,113 cotton spindles, or 85.8 per cent. of the 27,964,387 spindles in the United States.*

Mills which had 20.7 per cent. of the spindleage in the four

* Census Bulletin No. 97, pp. 10, 11.

New England States visited and 25.4 per cent. of the spindleage in the six Southern States visited were investigated. Some of these mills were located in cities, some in towns, and some in the country districts. In selecting mills for investigation, the aim was to select in each state those that would be representative of the industry, including some of the larger and some of the smaller mills, some that showed the best conditions, some that showed the worst, and some in which average conditions prevailed.

All of the 198 mills investigated were personally inspected by agents of the Bureau. No mill was reported unless its officers permitted the agent to have full access to all departments of the mill and to examine its pay roll. Information which agents obtained from their frequent inspections of the workrooms was supplemented by further information obtained from both employers and employees.

The following abstract of some of the more important features of the report is presented under the headings mentioned below:

I.—Porportion of woman and child operatives.
II.—Age and sex of operatives.
III.—Illegal employment of children in New England mills.
IV.—Illegal employment of children in Southern mills.
V.—Hours mills operated and hours operatives worked.
VI.—Earnings of operatives.
VII.—Working conditions of operatives.
VIII.—Races of operatives by sex and age.
IX.—Conjugal condition of operatives.
X.—School attendance and illiteracy.
XI.—Reasons assigned for employing children.

I. Proportion of Woman and Child Operatives.

Cotton manufacturing is by far the most important of the manufacturing industries of the country in which women and children are employed. About one eighth of all the women and about one fourth of all the children engaged in all kinds of manufacturing are employed in the cotton textiles industry. In 1905, nearly 60,000 more women were employed in this industry than in any other, and more children were em-

ployed in this industry than in any other four industries combined.*

While the growth of cotton manufacturing in the United States has been marked by a large increase in the number of women and children employed, there has been a very much larger increase in the proportion of men employed, with a corresponding decrease in the proportion of women and children employed, but more particularly the women. This is shown by the following table:

PER CENT. OF MALES AND OF FEMALES 16 YEARS OF AGE AND OVER AND OF CHILDREN UNDER 16 EMPLOYED IN THE COTTON INDUSTRY, BY GEOGRAPHICAL DIVISIONS, 1880–1905.

[From Census Bulletin No. 74, p. 39; also from Special Reports of Census Office, Manufactures, 1905, Part III, p. 29.]

Divisions.	Per cent. of males 16 years and over.				Per cent. of females 16 years and over.				Per cent. of children under 16 years.			
	1880.	1890.	1900.	1905.	1880. (a)	1890. (a)	1900.	1905.	1880. (b)	1890. (b)	1900.	1905.
New England States	36.2	43.3	48.2	49.0	49.7	49.8	45.1	45.0	14.1	6.9	6.7	6.0
Middle States	31.7	36.4	41.5	43.6	46.9	51.0	46.1	47.7	21.4	12.6	12.4	8.7
Southern States	28.4	34.4	41.6	45.5	46.5	41.4	33.4	31.6	25.1	24.2	25.0	22.9
Western States	26.3	30.4	34.4	29.6	52.0	56.4	56.6	58.8	21.7	13.2	9.0	11.6
Totals	34.6	40.6	45.1	46.9	49.0	48.7	41.5	40.2	16.4	10.7	13.4	12.9

(a) In 1880 and 1890 females 15 years and over.
(b) In 1880 and 1890 males under 16 years and females under 15 years.

That the tendency to employ a larger proportion of men and a smaller proportion of women and children continues was indicated by the investigation conducted by the Bureau of Labor. In the forty-six New England mills investigated, the women were 43.3 per cent., the children 5.2, and the men 51.5. In the one hundred fifty-two Southern mills investigated, the women were 27 per cent., the children 20, and the men 53.

II. Age and Sex of Operatives.

The following table shows, by state and sections, the number of employees of the mills investigated:

* Special Reports of Census Office, Manufactures, 1905, Part 1, pp. lxxv and lxxxi.

NUMBER OF ESTABLISHMENTS INVESTIGATED AND NUMBER AND PER CENT. OF EMPLOYEES OF EACH SEX AND EACH AGE GROUP, BY STATES.

State.	Establishments investigated.	Number of employees.						Per cent. of total employees.				
		16 years and over.		Under 16 years.			Total.	16 years and over.		Under 16 years.		
		M.	F.	M.	F.	Total.		M.	F.	M.	F.	Total.
NEW ENGLAND GROUP.												
Maine	7	2,582	2,855	244	253	497	5,934	43.5	48.1	4.1	4.3	8.4
New Hampshire	7	1,213	961	43	68	111	2,285	53.1	42.0	1.9	3.0	4.9
Massachusetts	22	9,623	7,773	285	320	605	18,001	53.4	43.2	1.6	1.8	3.4
Rhode Island	10	3,611	2,701	249	249	498	6,810	53.0	39.6	3.7	3.7	7.4
Total	46	17,029	14,290	821	890	1,711	33,030	51.5	43.3	2.5	2.7	5.2
SOUTHERN GROUP.												
Virginia	4	1,891	918	264	219	483	3,292	57.4	27.9	8.0	6.7	14.7
North Carolina	59	5,889	3,175	1,223	1,124	2,347	11,411	51.6	27.8	10.7	9.9	20.6
South Carolina	36	7,778	3,341	1,803	1,499	3,302	14,421	53.9	23.2	12.5	10.4	22.9
Georgia	31	6,248	3,277	927	900	1,827	11,352	55.0	28.9	8.2	7.9	16.1
Alabama	13	2,844	1,558	573	594	1,167	5,569	51.1	28.0	10.3	10.6	20.9
Mississippi	9	933	788	290	249	539	2,260	41.3	34.9	12.8	11.0	23.8
Total	152	25,583	13,057	5,080	4,585	9,665	48,305	53.0	27.0	10.5	9.5	20.0
Grand total	198	42,612	27,347	5,901	5,475	11,376	81,335	52.4	33.6	7.3	6.7	14.0

Except in Maine and Mississippi, the male operatives sixteen years of age and over outnumbered all other employees combined. In Mississippi there was, at the time of the investigation, no child-labor law. It was found that ordinarily, mills which manufactured yarn only employed a higher proportion of children than those which manufactured both yarn and cloth, that small mills employed a higher proportion of children than large mills, and that mills located in small or medium-sized towns employed a higher proportion of children than mills located in the larger cities.

The much higher percentage of children employed in Southern mills was due in part to the fact that in all States of that section, the employment of children of twelve and thirteen was legal and customary, while in New England, employment could not legally begin before the age of fourteen, except that in New Hampshire, children twelve years of age and over

might legally be employed when the schools were not in session. Another cause was the better enforcement of the child-labor laws in New England than in the South. Of the six Southern States, Mississippi had the highest proportion of children under sixteen years of age, 23.8 per cent. of all employees in mills investigated, while Virginia had the lowest, or 14.7 per cent. Of the four New England States, Maine had the highest proportion of children, 8.4 per cent., while Massachusetts had the lowest, 3.4 per cent.

In all the mills investigated the age, conjugal condition, nativity, and race of each employee were ascertained. In the case of the smaller mills, where the facts were known by the mill officials, such data were obtained from them. In the case of the large mills, the facts were obtained from the employees, either in the mill or at their homes, by personal inquiry on the part of the agents of the Bureau. In securing such information, the overseers of different departments frequently assisted. In the case of a number of the larger mills, printed slips asking for the desired information were distributed among the employees and were collected after being filled.

Great care was taken to verify the ages of children under sixteen, as reported by the children themselves or by the mill officials, especially in the cases of the younger children. This was done by interrogating the children, their parents, or other members of the family, and frequently teachers of the schools which the children had attended. In New England the ages of many children were verified by the records of births kept by public officials, but this could be done only for children who were born where the mills in which they worked were located, and then only when the mills were located where public records of births were kept. In the South, verification could not be made by consulting public records of birth except in certain large cities where births are recorded, but wherever possible verification was made by consulting the family Bibles of families whose homes were visited.

So far as means of verification could be found, the ages of the younger children were verified. Both the ages as reported by the employers, and the ages as otherwise ascertained were reported. But the agents of the Bureau did not de-

pend on their own judgment of the ages of children. In no case has an estimate of the age according to the appearance of the child been used; and unless proof was obtained which showed that the age furnished by the child or by the mill official was inaccurate, that statement of age was always accepted. The result is, beyond question, that many young children under fourteen years of age, and some of fourteen and fifteen were reported as one, two, or three years older than the true age, and the number of children under the legal age who were actually employed was certainly considerably in excess of the figures given in this report. In the case of some operatives sixteen years of age and over, they were entered as being "sixteen and over" or "twenty-one and over" because the mill officials were not able to state the age more definitely.

Five mills in New England and seven mills in the South refused to admit agents of the Bureau to their work rooms, and three other Southern mills refused to permit agents to copy the names on their pay rolls, so none of these mills were investigated. The difficulties of ascertaining the extent to which the age limit laws were violated were increased by attempts on the part of certain manufacturers in the South to conceal actual conditions. In ten mills which were investigated—three in North Carolina, six in South Carolina, and one in Georgia—positive proof was obtained that small children were discharged temporarily, sent home for a few hours or a few days, or hidden in entries, in water closets, or in waste boxes, anywhere so that they would not be discovered by the agent when going through the mill. In other cases, where no elaborate attempt at deception was made, manufacturers misstated the ages of children either through ignorance or a desire to deceive. Not all of these misstatements could be disproved. The full extent of the violation of the age limit laws is therefore not shown in the report.

III. Illegal Employment of Children in New England Mills.

At the time of the investigation, the laws of each of the four New England States visited forbade the employment of

children under fourteen years of age in factories, except as mentioned in New Hampshire, and except as to the canning industry in Maine. These laws have not been changed as regards the age limit. In each of the four States there was a factory inspection system.

The extent to which the laws fixing a minimum working age for children were found to be violated in New England mills is shown in the following table:

NUMBER OF CHILDREN EMPLOYED IN COTTON MILLS INVESTIGATED IN THE NEW ENGLAND GROUP, BY STATES, AND NUMBER AND PER CENT. EMPLOYED UNDER THE LEGAL AGE (14 YEARS).

State.	Total mills investigated.					Mills employing children under 14 years.				
	Number.	Children employed—				Number.	Children employed—			
		Under 16 years.	Under 14 years.				Under 16 years.	Under 14 years.		
			Legally.	Illegally.	Per cent. illegally employed.			Legally.	Illegally.	Per cent. illegally employed.
Maine	7	497	.....	64	12.9	7	497	.....	64	12.9
New Hampshire	7	111	5	5	4.5	a3	67	5	5	4.5
Massachusetts	22	605	.....	1	.2	1	17	.....	1	5.9
Rhode Island	10	498	.....	50	10.0	5	338	.....	50	14.8
Total	46	1,711	5	120	7.0	15	919	5	120	13.1

a. In New Hampshire 2 mills employed children illegally, and 1 legally employed 5 children under 14 years of age while school was in session.

In Maine every mill investigated had children under the legal age at work. Out of the 497 children under sixteen years of age employed in the mills inspected in that State, 64, or 12.9 per cent., were found to be under the legal age. In Rhode Island, one half of the mills investigated were found to be employing children under the legal age; and of the 498 children under sixteen of years age employed in the mills inspected, 50, or 10 per cent., were found to be under the legal age. A few children were found employed under the legal age in New Hampshire, and a few others under fourteen years who were legally employed under the provision of the law of that State which permits employment of children over twelve years of age during vacation. In Massachusetts only one child under the legal age was found at work.

The number of children at each age under fourteen years found in the forty-six mills investigated in New England is briefly summarized in the following table:

NUMBER OF CHILDREN OF EACH AGE UNDER THE LEGAL AGE (14 YEARS) EMPLOYED IN COTTON MILLS INVESTIGATED IN THE NEW ENGLAND GROUP, BY STATES.

Age.	Maine.	New Hampshire.	Massachusetts.	Rhode Island.	Total.
10 years	2	.....	.....	.....	2
11 years	10	2	.....	2	14
12 years	11	.....	.....	7	18
13 years	41	a8	1	41	a91
Total	64	a10	1	50	a125

a. Including 5 children employed when school was not in session, and so legally employed.

A detailed table in the report shows that one mill in New Hampshire employed fourteen children under fifteen years of age, of whom four, or 28.6 per cent., were employed illegally; and that one mill in Rhode Island employed 114 children under sixteen years of age, of whom 33, or 28.9 per cent., were employed illegally.

Of the 120 children under fourteen years of age who were illegally at work in the New England mills investigated, the names of 97 appeared on the pay rolls, and the names of 23 were omitted therefrom. The practice of employing children without entering their names on the pay rolls is an evasion of the law, and is explained in the next section of this abstract.

In New England, there were violations not only of the age limit laws, but of the laws which require age certificates or age and school certificates to be kept on file by the employer for all children fourteen and fifteen years of age. In Massachusetts and New Hampshire employees under sixteen must be able to read and write in English, but in Maine and Rhode Island, there is no educational requirement. The extent to which the requirement in regard to certificates being kept on file was found to be violated is shown in the following table:

NUMBER AND PER CENT. OF NEW ENGLAND COTTON MILLS INVESTIGATED VIOLATING THE EMPLOYMENT CERTIFICATE LAW, AND NUMBER AND PER CENT. OF CHILDREN 14 AND 15 YEARS OLD AT WORK WITHOUT CERTIFICATES, BY STATES.

State.	Establishments investigated as to observance of the certificate laws.			Children 14 and 15 years of age at work in establishments so investigated.		
	Total.	Violating the laws.		Total.	Without certificates.	
		Number.	Per cent.		Number.	Per cent.
Maine	6	6	100.0	293	137	46.8
New Hampshire	5	3	60.0	80	9	11.3
Massachusetts	19	3	15.8	510	18	*3.5
Rhode Island	9	9	100.0	400	a188	47.0
Total	39	21	53.8	1,283	a352	27.4

a. Including 9 with certificates issued on sworn statement.

This table shows that in the mills visited the law was well observed in Massachusetts, and fairly well observed in New Hampshire. In both Maine and Rhode Island, the law was flagrantly violated. None of the establishments investigated on this point in these two states had certificates for all children as required, and in three mills in each State more than half of the children fourteen and fifteen years old were without the certificates required by law.

IV. Illegal Employment of Children in Southern Mills.

As already mentioned, Mississippi had no child-labor law at the time of the investigation, while the laws of the other five Southern States visited prohibited the employment in factories, of children under twelve years of age, except in canning factories in North Carolina. The laws of two States, South Carolina and Georgia, excepted orphans and children of widows or of aged or disabled fathers from the provisions of the laws if they were dependent upon their own labor for their support. The laws of Georgia permitted the employment of such children if ten years of age and the laws of South Carolina permitted their employment at any age. Since the investigation was made the age limit has been raised to fourteen in Virginia; in North Carolina, it has been raised to thirteen years, with the employment of apprentices permitted at

the age of twelve, and Mississippi has enacted a law which forbids the employment of children under twelve years of age.

At the time of this investigation, although five of the six Southern States visited had child-labor laws, in only two was any provision made for enforcement of those laws or for factory inspection. Virginia has had factory inspection since 1906. A law which provided that the inspector of jails and almshouses should also act as inspector of factories went into effect in Alabama shortly before the State was visited in this investigation. The inspector, however, had not begun work at the time the mills in the State were investigated. Two other States, South Carolina and Mississippi, have made provision for factory inspection since the field work was completed.

The extent to which the laws fixing a minimum working age for children were found to be violated in Southern mills is shown in the following table, which includes Mississippi, where there was no child-labor law:

NUMBER OF CHILDREN EMPLOYED IN COTTON MILLS INVESTIGATED IN THE SOUTHERN GROUP, BY STATES, AND NUMBER AND PER CENT. EMPLOYED UNDER THE LEGAL AGE (12 YEARS).

State.	Total mills investigated.					Mills employing children under 12 years.				
	Number.	Children employed—				Number.	Children employed—			
		Under 16 years.	Under 12 years.				Under 16 years.	Under 12 years.		
			Legally.	Illegally.	Per cent. illegally employed.			Legally.	Illegally.	Per cent. illegally employed.
Virginia	4	483	.....	9	1.9	2	434	.....	9	2.1
North Carolina	59	2,347	.....	202	8.6	44	1,751	.....	202	11.5
South Carolina	36	3,302	42	405	12.3	a34	3,185	42	405	12.9
Georgia	31	1,827	41	66	3.6	b22	1,366	41	66	5.8
Alabama	13	1,167	.....	71	6.1	8	943	.....	71	7.5
Mississippi	9	539	113	.....	.....	c9	539	113	.....	.....
Total	152	9,665	196	753	7.9	116	8,218	196	753	9.2

a. In South Carolina 33 mills employed children illegally, and 1 legally employed 1 child under 12 years of age who were under legal exceptions.
b. In Georgia 20 mills employed children illegally, 1 legally employed 1 child under 12 years of age who was under legal exceptions, and 1 legally employed 15 children under 12 years of age, who were under legal exceptions.
c. In Mississippi there was no child-labor law at the time of the investigation.

It appears that although the child-labor laws were found to be flagrantly violated in all Southern States visited having such laws, and particularly in North Carolina and South Caro-

lina, yet these laws have had no little effect in reducing the number of child employees under twelve years of age. The industry in Mississippi is newer than in the other States, and this would account in part for the higher proportion of children. The difference, however, was too great to be entirely accounted for in this way, and was without doubt due to the absence then of law on the subject in that State. At the same time, it should be noted that a few mills in North Carolina and South Carolina had practically as high a proportion of children under twelve as any in Mississippi and that many had a higher proportion than the average for that State.

Of children under sixteen years of age at work, the proportion under twelve years was very much higher in certain mills in each State than the average proportion for the State as shown in the table. It was as high as 41 per cent. in one South Carolina mill, 37 in a Mississippi mill, 35.7 in a North Carolina mill, 27.6 in a Georgia mill, 21.7 in an Alabama mill, and 4.1 in a Virginia mill.

The number of children at each age under twelve found employed in the mills investigated in each Southern State visited is summarized in the following table:

NUMBER OF CHILDREN OF EACH AGE UNDER 12 YEARS ON PAY ROLLS, AND NUMBER NOT ON PAY ROLLS, EMPLOYED IN COTTON MILLS INVESTIGATED IN THE SOUTHERN GROUP, BY STATES.

[Only children admitted or positively proved to be under 12 are included in this table as under that age.]

Age.	Virginia.			North Carolina.			South Carolina.			Georgia.			Alabama.			Mississippi.			Total.		
	On pay roll.	Not on pay roll.	Total.	On pay roll.	Not on pay roll.	Total.	On pay roll.	Not on pay roll.	Total.	On pay roll.	Not on pay roll.	Total.	On pay roll.	Not on pay roll.	Total.	On pay roll.	Not on pay roll.	Total.	On pay roll.	Not on pay roll.	Total.
7 years	...	...	...	1	3	4	...	a7	7	...	1	1	1	...	1	2	2	4	4	a13	a17
8 years	...	...	...	8	7	15	9	15	24	...	...	...	3	...	3	6	...	6	26	22	48
9 years	...	...	...	21	6	27	32	20	52	4	2	6	3	1	4	17	1	18	77	30	107
10 years	1	1	2	37	12	49	110	37	147	19	8	27	20	3	23	35	...	35	222	61	283
11 years	4	3	7	94	13	107	202	15	217	68	5	73	38	2	40	49	1	50	455	39	494
Total	5	4	9	161	41	202	353	94	447	91	16	107	65	6	71	109	4	113	784	165	949

a. Including 1 child 6 years of age.

Of the 753 children illegally at work in the Southern mills investigated, the names of 592 appeared upon the pay rolls, and the names of 161 were omitted therefrom. The wages

of these 161 children were included with those of some other member of the family, and they were what are commonly known as "helpers." Because they are unquestionably under the legal age, however, and are admitted so to be, the employer refuses to place their names upon the books of the company, but does not refuse to give them work, if some other member of the family can be induced to carry the "helper's" wages home.

In other words, the helper system ordinarily is merely a subterfuge whereby a law which prohibits the employment of children under a certain age is evaded. If the name is omitted from the pay roll, the employer argues that he is not "employing" the child. The fact that the child has an assigned task, the work being done by the manufacturer's direction and for his benefit, and the fact that the employer willingly pays for it in a relative's pay envelope, fail to alter this conclusion. Of course, where the law provides that a child under a certain age "shall not be employed or permitted or suffered to work in or about any manufacturing establishment," it can not be evaded in this way, but thus far, such a provision has been kept out of child-labor laws in North Carolina and South Carolina, where the helper system mostly prevails. Provisions of this character are contained, however, in the laws of the other Southern States visited.

In none of the Southern States visited were there any compulsory school laws, except in one or two localities in North Carolina, but in North Carolina, no child under thirteen could be legally employed in a factory (canning factories excepted) unless he had attended school sixteen weeks during the previous year; in Georgia, no child under fourteen could be legally employed in a factory unless he had attended school twelve weeks during the previous year; in Alabama, no child between twelve and sixteen could be legally employed in a factory unless he had attended school eight weeks during the previous year. However, little attention was paid by manufacturers to these requirements.

The laws requiring written proof of age and requiring affidavits to legalize the employment of the children of widows or of aged or disabled fathers were freely violated. In South Carolina and Georgia, it was found that many children em-

ployed under affidavits declaring that their fathers were disabled should not have been permitted to work as their fathers were able bodied. In North Carolina, very little attention was paid to the laws requiring written statements of the ages of children.

V. Hours Mills Operated and Hours Operatives Worked.

At the time of this investigation, the laws of Maine restricted the hours of labor for women and children in factories to sixty per week, and the laws of New Hampshire, Massachusetts, and Rhode Island limited the hours for such employees to fifty-eight. Since that time, the limit has been reduced to fifty-eight in Maine and to fifty-six in Massachusetts and Rhode Island. All mills investigated in New England operated the legal time except one in Maine which operated 61.8 hours a week.

The laws of North Carolina and Georgia restricted the hours of labor for women and children in factories to sixty-six per week, and the laws of Virginia and Alabama limited them to sixty. During the investigation, the legal hours in South Carolina were reduced from sixty-two to sixty. Except a few mills in South Carolina which did not change their working hours promptly, no violations of the law as regards working hours were found outside of Alabama, where of thirteen mills all but three exceeded the legal hours, and one operated as long as sixty-seven hours and fifteen minutes. In Mississippi there was no law on the subject, and the mills investigated operated from sixty hours to sixty-eight hours and fifteen minutes but since the time of the investigation, the hours have been legally fixed at fifty-eight.

The hours actually worked by operatives during a representative week were obtained from the pay rolls of the mills investigated. The following table shows for each of the ten states the average hours operated by the mills and the hours actually worked by the operatives.

AVERAGE REGULAR OPERATING TIME AND AVERAGE HOURS WORKED IN A REPRESENTATIVE WEEK BY MALE AND FEMALE EMPLOYEES IN COTTON MILLS INVESTIGATED, BY STATES.

State.	Average hours regular operating time.	Average hours worked in a representative week.	
		Males.	Females.
NEW ENGLAND GROUP			
Maine	60.1	50.9	50.2
New Hampshire	58.0	45.0	46.2
Massachusetst	58.0	50.8	49.6
Rhode Island	58.0	51.3	52.0
Total	58.4	50.7	50.1
SOUTHERN GROUP			
Virginia	60.0	50.2	50.1
North Carolina	63.6	54.7	54.6
South Carolina	61.1	48.7	48.6
Georgia	64.0	48.9	49.4
Alabama	63.9	48.4	48.6
Mississippi	62.4	53.7	53.9
Total	62.7	50.3	50.6

When the mills of the Northern and Southern groups, taken as a whole, are compared, it will be seen that, while the regular operating time in the New England mills investigated averaged 58.4 hours against 62.7 in the Southern mills, the average hours actually worked in a representative week in the two sections differed but slightly. The males in the New England group averaged 50.7 hours, against 50.3 for the males in the Southern group, while the females in the New England mills averaged 50.1 hours, against 50.6 for the females in the Southern mills.

Of the fifty-nine mills investigated in North Carolina, twenty-eight operated at night and twenty-seven employed at night children under sixteen years of age. The proportion of such children to the all-night employees in these twenty-seven mills varied from 9.1 to 74.5 per cent. Of the thirty-six mills investigated in South Carolina, four operated at night and the proportion of children under sixteen years of age working at night to the all-night employees varied from 16.7 to 42 per cent.

VI. EARNINGS OF OPERATIVES.

The difference between the wages paid in New England mills and those paid in Southern mills is illustrated by detailed

tables in the report showing the average hourly earnings of operatives of various ages employed in occupations in which women and children were engaged in Massachusetts and North Carolina. The average earnings of such operatives of all ages were .149 per hour for males and .136 for females in Massachusetts, and .097 for males and .087 for females in North Carolina. In Massachusetts, the maximum average earnings of males was .180 per hour, which was reached by them when from forty-five to forty-nine years of age, and of females .154, which was reached by them when from thirty-five to forty-four years. In North Carolina, the maximum average earnings of males was .137 per hour, which was reached by them when from twenty-five to twenty-nine years of age, and of females .106, which was reached by them when from thirty to thirty-four years.

In the following table are given for each section the average actual earnings of operatives in six occupations during a representative week, and their computed earnings on a full-time basis:

AVERAGE ACTUAL AND FULL TIME (COMPUTED) EARNINGS IN A REPRESENTATIVE WEEK OF MALE AND FEMALE EMPLOYEES 16 YEARS OF AGE AND OVER IN THE NEW ENGLAND AND IN THE SOUTHERN MILLS INVESTIGATED.

Occupation.	44 New England mills.				151 Southern mills.			
	Males.		Females.		Males.		Females.	
	Actual earnings per week.	Computed full-time earnings per week.	Actual earnings per week.	Computed full-time earnings per week.	Actual earnings per week.	Computed full-time earnings per week.	Actual earnings per week.	Computed full-time earnings per week.
Doffers	$5.62	$6.77	$4.85	$6.07	$4.05	$5.08	$2.86	$4.70
Ring spinners	5.63	6.77	6.17	7.36	4.41	5.96	4.54	5.71
Scrubbers and sweepers	5.32	6.02	4.74	5.66	4.15	5.08	2.96	3.76
Speeder tenders	8.44	9.64	7.67	8.88	6.38	8.21	5.64	7.09
Spoolers	.....	.....	5.79	6.77	4.85	6.08	4.39	5.71
Weavers	8.76	9.93	7.85	8.99	6.76	8.53	5.82	7.21

The following table shows for the New England and the Southern families visited having married women at work the the average size and income of such families, according to condition as to husband:

AVERAGE SIZE AND EARNINGS OF FAMILIES OF MARRIED WOMEN AT WORK, BY CONDITION AS TO HUSBAND.

Condition as to husband.	Families.			Annual family income.			Average per capita weekly income excluding earnings of wives.	Families having a per capita weekly income excluding earnings of wives of less than $2.	
	Number.	Per cent. of total.	Average size.	Earnings of wives.	Excluding earnings of wives.	Total.		Number.	Per cent.
NEW ENGLAND GROUP									
Widows	34	20.9	3.7	$307	$476	$783	$2.49	14	41.2
Deserted and divorced wives	10	6.1	3.9	261	417	678	2.06	3	30.0
Wives of incapacitated husbands	4	2.5	5.0	303	566	869	2.18	2	50.0
Wives of idle husbands	3	1.8	6.0	303	912	1,215	2.92	.....	.....
Wives with husbands at work	112	68.7	5.1	306	728	1,034	2.73	30	26.8
Total	163	100.0	4.8	303	656	959	2.65	49	30.1
SOUTHERN GROUP.									
Widows	66	26.2	4.7	189	434	623	1.78	39	59.1
Deserted and divorced wives	33	13.1	4.9	194	366	560	1.42	25	75.8
Wives of incapacitated husbands	7	2.8	5.1	183	442	625	1.65	5	71.4
Wives of idle husbands	3	1.2	5.3	189	327	516	1.18	3	100.0
Wives with husbands at work	143	56.7	5.4	183	581	764	2.08	68	47.6
Total	252	100.0	5.1	186	508	694	1.90	140	55.6

In the New England group, the average size of the 163 families visited was 4.8 members. The average annual income per family was $959, of which $303, or 31.6 per cent., was contributed by the wives, and $656, or 68.4 per cent., was from other members of the family or from other sources than wage earnings. The per capita weekly income of these families, excluding earnings of wives, was $2.65, the average for 49 of them, or 30.1 per cent., being less than $2. The highest annual average earnings of the women workers in this group were those of widows ($307), while deserted and divorced wives received the lowest average ($261).

In the Southern group, the average size of the 252 families visited was 5.1 members and the average annual income per family was $694, of which the wives contributed $186, or 26.8 per cent.; and $508, or 73.2 per cent., was from other members of the family or from other sources than wage earnings. The per capita weekly income, excluding that of wives, was $1.90. The highest average annual earnings of the women workers in this group were those of deserted and divorced wives ($194), while wives with husbands at work received the lowest average ($183). The number of wives of incapacitated hus-

bands and of idle husbands is too small in both sections to be used for comparative purposes.

The following table is compiled from data secured from families in which there were wage-earning children sixteen years of age and over:

AVERAGE INDIVIDUAL EARNINGS OF CHILDREN OF EACH SEX 16 YEARS OF AGE AND OVER AT WORK, AVERAGE CONTRIBUTIONS OF SUCH CHILDREN TO FAMILY INCOME AND PER CENT. OF THEIR EARNINGS SO CONTRIBUTED, BY NATIVITY AND RACE OF HEADS OF FAMILIES.

Nativity and race of head of family.	Number of families with—		Children 16 years and over at work.					
			Average earnings of—		Average amount contributed to family by—		Per cent. of earnings contributed to family by—	
	Male children 16 years and over at work.	Female children 16 years and over at work.	Males.	Females.	Males.	Females.	Males.	Females.
NEW ENGLAND GROUP.								
Native born, native parents	14	26	$412	$302	$283	$282	68.7	93.4
Native born, foreign parents:								
French Canadian	9	17	332	304	332	297	100.0	97.7
English	3	4	488	389	488	377	100.0	96.9
Irish	7	10	343	284	254	246	74.1	86.6
Italian	.....	.....	.....	.....	.....	.....	.....	.....
Polish	.....	.....	.....	.....	.....	.....	.....	.....
Portuguese	1	1	480	366	480	366	100.0	100.0
Other races	3	2	293	276	293	176	100.0	63.8
Total	23	34	355	307	318	285	89.6	92.8
Foreign born:								
French Canadian	205	305	353	311	284	300	80.5	96.5
English	35	57	424	378	365	371	86.1	98.1
Irish	45	74	379	344	306	330	80.7	95.9
Italian	11	20	365	331	269	326	73.7	98.5
Polish	8	15	376	283	376	283	100.0	100.0
Portuguese	24	36	330	328	321	323	97.3	98.5
Other races	24	35	367	310	315	298	85.8	96.1
Total	352	542	362	323	299	313	82.6	96.9
Total, New England group	389	602	364	321	300	310	82.4	96.6
SOUTHERN GROUP.								
Native born, native parents	641	886	267	237	194	211	72.7	89.0

The number of families in which there were wage-earning male children sixteen years of age and over was notably less than the number having wage-earning female children in the same age group.

Although the average earnings of the males in this age group were in each nativity and race group greater than those of the females, yet the average amount contributed to the family out of such earnings by the females exceeds that contributed

by the males in both the New England and the Southern group.

In the Southern group, the females contributed 89 per cent. of their individual earnings to the family and the males contributed 72.7 per cent.

VII. Working Conditions of Operatives.

The following table shows for each State the number of mills investigated which were found to be provided with fire escapes and the number which had made no such provision. A column is also added to show which of the States have legal requirements as to fire escapes.

NUMBER OF COTTON MILLS INVESTIGATED OF OVER TWO STORIES PROVIDING AND NUMBER NOT PROVIDING FIRE ESCAPES AND LEGAL REQUIREMENTS AS TO FIRE ESCAPES, BY STATES.

State.	Number of establishments investigated.	Establishments of over two stories.	Establishments where fire escapes were—		Fire escapes required by law.
			Provided.	Not provided.	
New England Group.					
Maine	7	7	7	.....	When workers are above first story.
New Hampshire	7	7	7	.....	No.
Massachusetts	22	21	19	2	Required when 10 or more persons work above second story.
Rhode Island	10	10	8	2	When buildings are of three or more stories.
Southern Group.					
Virginia	4	3	1	2	When buildings are over three stories.
North Carolina	59	12	1	11	No.
South Carolina	36	21	1	20	No.
Georgia	31	16	5	11	No.
Alabama	13	6	1	5	No.
Mississippi	9	5	.....	5	No.

There is no overcrowding of operatives in cotton mills, but in some mills the machinery is placed too close together, so that the danger from accidents is increased. In 5 of the 46 mills investigated in New England and in 76 of the 152 mills investigated in the South the sanitary condition of the water closets was bad.

The dust and lint found in cotton mills are disagreeable and injurious to health, especially as regards persons who are predisposed to affections of the throat or lungs. In a large majority of the mills which were inspected much dust and lint were seen. Though the number in which there was very

little was comparatively small, it was sufficient to show that it is not only possible, but entirely practicable, to remove nearly all the dust and lint by constant sweeping, scrubbing, and cleaning. This point can not be too strongly emphasized, that there is no necessity for so much dust and lint as are usually found in cotton mills. It is merely a matter of expense in employing enough sweepers and scrubbers, and, where necessary, cleaners or wipers, though the operatives on most machines can keep them wiped off without much loss of time. The additional expense for sweepers and scrubbers, in order to keep a mill clean and its workrooms wholesome, is a comparatively small item, and does not appreciably increase the cost of manufacture.

Women who work in cotton mills are required to stand practically all of the time in all occupations except that of drawing-in, in which few employees are engaged, and all child workers are required to be on their feet practically all of the time except doffers, who in most mills have intervals of rest.

Of the families reported, 14.8 per cent. owned their dwellings in New England, and 4.9 per cent in the South. In the South there are many villages in which all of the land and houses are owned by the mill company. In New England many mill companies have sold the houses which they built for operatives. The average rent paid by New England families living in company houses was $6.32 per month, and in non-company houses, $9.26; by Southern families living in company houses, $3.57, and in non-company houses, $5.31. The per cent. of family earnings devoted to rent in New England was 6.4 among families living in company houses, and 10.0 among families living in non-company houses. The corresponding per cents. in the South were 4.8 and 7.2.

In New England practically all cotton mills which formerly did welfare work have abandoned it, because the city or some other agency has taken it over. Of the 152 Southern mills, 76 supported or partly supported day schools, 32 supported or partly supported kindergartens, 8 paid salaries to welfare workers, and 10 paid salaries to trained nurses. Some mills engage in other forms of welfare work.

In New England there are practically no stores owned by

cotton mills, but 57 of the 152 mills investigated in the South had stores owned by the mill or the mill officials. These stores usually carried a larger variety of goods than the independent stores, sold at about the same prices, and were protected from loss, because store accounts were deducted from the earnings of employees on every pay day.

VIII. Races of Operatives by Sex and Age.

In the 46 New England mills investigated there were 22,665 employees of both sexes in occupations in which women and children were employed, and the races of 21,915 of them were reported. The following table shows for these 21,915 operatives the number and per cent. of each specified race, by sex and age groups. All native-born persons of native parents are included under American. Under the other races specified are included both foreign-born persons and native-born persons whose fathers were foreign-born.

NUMBER AND PER CENT OF EMPLOYEES OF EACH RACE REPORTED IN COTTON MILLS IN THE NEW ENGLAND GROUP, BY SEX AND AGE.

Race.	16 years and over.				Under 16 years.				Total.	
	Males.		Females.		Males.		Females.			
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
American	286	4.5	1,134	8.2	76	9.7	73	8.5	1,569	7.2
English	604	9.5	1,350	9.7	87	11.2	73	8.5	2,114	9.6
French Canadian	2,610	40.9	5,633	40.5	410	52.6	499	58.1	9,152	41.8
Irish	334	5.2	2,288	16.5	50	6.4	63	7.3	2,735	12.5
Italian	303	4.8	249	1.8	36	4.6	35	4.1	623	2.8
Polish	920	14.4	1,759	12.6	26	3.3	38	4.4	2,743	12.5
Portuguese	322	5.0	680	4.9	34	4.4	41	4.8	1,077	4.9
Other races	1,001	15.7	803	5.8	61	7.8	37	4.3	1,902	8.7
Total	6,380	100.0	13,896	100.0	780	100.0	859	100.0	21,915	100.0

French Canadians show the highest percentage of operatives in every group presented in this table, 41.8 per cent. of all the operatives considered being of this race. Next to these were the Polish and the Irish, each with 12.5 per cent., followed in order by the English, American, Portuguese, and Italian.

The following table, which refers to the same individuals

as the preceding table is designed to show for each race the number and per cent. of employees of each sex above and below sixteen years of age, but males sixteen years of age and over in occupations in which women and children are not engaged are omitted from the enumeration:

NUMBER AND PER CENT. OF MALE AND FEMALE EMPLOYEES 16 YEARS OF AGE AND OVER AND OF THOSE UNDER 16 YEARS OF AGE, IN COTTON MILLS IN THE NEW ENGLAND GROUP, BY RACE.

Race.	Employees 16 years and over.				Employees under 16 years.				Total.	
	Males.		Females.		Males.		Females.		Number.	Per cent.
	Number.	Per cent.	Number	Per cent.	Number.	Per cent.	Number.	Per cent.		
American	286	18.2	1,134	72.3	76	4.8	73	4.7	1,569	100.0
English	604	28.6	1,350	63.9	87	4.1	73	3.4	2,114	100.0
French Canadian	2,610	28.5	5,633	61.5	410	4.5	499	5.5	9,152	100.0
Irish	334	12.2	2,288	83.7	50	1.8	63	2.3	2,735	100.0
Italian	303	48.6	249	40.0	36	5.8	35	5.6	623	100.0
Polish	920	33.5	1,759	64.1	26	1.0	38	1.4	2,743	100.0
Portuguese	322	29.9	680	63.1	34	3.2	41	3.8	1,077	100.0
Other races	1,001	52.6	803	42.2	61	3.2	37	2.0	1,902	100.0
Total	6,380	29.1	13,896	63.4	780	3.6	859	3.9	21,915	100.0

In the South practically all cotton mill operatives are native born white Americans, except that in some mills negroes are employed to do the heaviest work in the picker and card rooms. Most of the Southern operatives have come from the farms surrounding the mills, but some have come from the mountains of North Carolina and Tennessee.

IX. Conjugal Condition of Operatives.

Information was secured to show the sex, age, and conjugal condition of operatives employed in occupations in which women and children were employed. The following table shows the conjugal condition of such employees who were 16 years of age or over. The table shows that in the New England group 42.7 per cent. of the male operatives 16 years of age and over were married, as against 29.6 per cent. of the females of that age. In the Southern group 44.9 per cent. of the males were married, as against 27.9 per cent. of the females.

NUMBER AND PER CENT. OF MALE AND OF FEMALE EMPLOYEES 16 YEARS OF AGE AND OVER OF EACH CONJUGAL CONDITION IN COTTON MILLS INVESTIGATED, BY STATES AND GROUPS OF STATES.

NUMBER.

State.	Males 16 years of age and over.				Females 16 years of age and over.			
	Single.	Married.	Widowed, divorced, separated and deserted.	Total.	Single.	Married.	Widowed, divorced, separated, and deserted.	Total.
NEW ENGLAND GROUP.								
Maine	562	448	17	1,027	1,835	847	139	2,821
New Hampshire	172	163	6	341	545	278	57	880
Massachusetts	1,958	1,375	52	3,385	5,004	2,228	303	7,535
Rhode Island	868	738	21	1,627	1,777	757	126	2,660
Total	3,560	2,724	96	6,380	9,161	4,110	625	13,896
SOUTHERN GROUP.								
Virginia	429	401	21	851	485	311	91	887
North Carolina	958	773	11	1,742	2,033	634	97	2,764
South Carolina	1,643	1,513	11	3,167	2,210	962	179	3,351
Georgia	1,175	916	13	2,104	1,943	956	221	3,120
Alabama	673	466	12	1,151	1,006	439	114	1,559
Mississippi	192	118	6	316	515	168	89	772
Total	5,070	4,187	74	9,331	8,192	3,470	791	12,453

PER CENT.

State.	Males 16 years of age and over.				Females 16 years of age and over.			
	Single.	Married.	Widowed, divorced, separated, and deserted.	Total.	Single.	Married.	Widowed, divorced, separated, and deserted.	Total.
NEW ENGLAND GROUP.								
Maine	54.7	43.6	1.7	100.0	65.1	30.0	4.9	100.0
New Hampshire	50.4	47.8	1.8	100.0	61.9	31.6	6.5	100.0
Massachusetts	57.9	40.6	1.5	100.0	66.4	29.6	4.0	100.0
Rhode Island	53.3	45.4	1.3	100.0	66.8	28.5	4.7	100.0
Total	55.8	42.7	1.5	100.0	65.9	29.6	4.5	100.0
SOUTHERN GROUP.								
Virginia	50.4	47.1	2.5	100.0	54.7	35.1	10.2	100.0
North Carolina	55.0	44.4	.6	100.0	73.6	22.9	3.5	100.0
South Carolina	51.9	47.8	.3	100.0	66.0	28.7	5.3	100.0
Georgia	55.9	43.5	.6	100.0	62.3	30.6	7.1	100.0
Alabama	58.5	40.5	1.0	100.0	64.5	28.2	7.3	100.0
Mississippi	60.8	37.3	1.9	100.0	66.7	21.8	11.5	100.0
Total	54.3	44.9	.8	100.0	65.8	27.9	6.3	100.0

The following table shows for operatives of each sex 16 years of age and over in the New England group the number and per cent. of each conjugal condition by races:

NUMBER AND PER CENT. OF MALE AND OF FEMALE EMPLOYEES 16 YEARS OF AGE AND OVER OF EACH CONJUGAL CONDITION IN COTTON MILLS INVESTIGATED IN THE NEW ENGLAND GROUP, BY RACE.

NUMBER.

Race.	Males 16 years of age and over.				Females 16 years of age and over.			
	Single.	Married.	Widowed, divorced, separated, and deserted.	Total.	Single.	Married.	Widowed, divorced, separated, and deserted.	Total.
American	177	103	6	286	781	266	87	1,134
English	235	355	14	604	785	502	63	1,350
French Canadian	1,367	1,209	34	2,610	3,752	1,674	207	5,633
Irish	177	139	18	334	1,552	561	175	2,288
Italian	195	107	1	303	165	75	9	249
Polish	479	431	10	920	1,138	578	43	1,759
Portuguese	218	102	2	322	422	241	17	680
Other races	712	278	11	1,001	566	213	24	803
Total	3,560	2,724	96	6,380	9,161	4,110	625	13,896

PER CENT.

American	61.9	36.0	2.1	100.0	68.9	23.4	7.7	100.0
English	38.9	58.8	2.3	100.0	58.1	37.2	4.7	100.0
French Canadian	52.4	46.3	1.3	100.0	66.6	29.7	3.7	100.0
Irish	53.0	41.6	5.4	100.0	67.8	24.5	7.7	100.0
Italian	64.4	35.3	.3	100.0	66.3	30.1	3.6	100.0
Polish	52.1	46.8	1.1	100.0	64.7	32.9	2.4	100.0
Portuguese	67.7	31.7	.6	100.0	62.1	35.4	2.5	100.0
Other races	71.1	27.8	1.1	100.0	70.5	26.5	3.0	100.0
Total	55.8	42.7	1.5	100.0	65.9	29.6	4.5	100.0

This table, relating to employees 16 years of age and over, shows that of the various races in the New England group that having the largest proportion of married men was the English with 58.8 per cent. while of the women of this race 37.2 per cent. were married. For every race shown except the Portuguese the proportion of men who were married was larger than that of women, 31.7 per cent. of the Portuguese males being married as against 35.4 per cent. of the females.

During the investigation careful inquiries were made in the various communities visited among physicians, teachers, and ministers of various denominations concerning the effect of employment in the mills upon the morals of the operatives.

In practically all mills in the country districts and the smaller towns the moral standard was high. Occasionally particular mills in the larger cities were found in which, through lax discipline and indifference on the part of the management, a low moral tone prevailed, but, on the whole, nothing was found to indicate that employment in cotton mills had any different moral effect upon the women and children than employment in any other line of factory work.

X. School Attendance and Illiteracy.

In the following table the children 6 to 15 years of age in the families visited in New England and the South are presented by age groups:

NUMBER AND PER CENT. OF CHILDREN 6 TO 15 YEARS OF AGE IN COTTON-MILL FAMILIES VISITED WHO WERE AT WORK, AT SCHOOL, AND AT HOME, BY AGE GROUPS.

Age group.	New England group.							Southern group.						
	Total number.	At work.		At school.		At home.		Total number.	At work.		At school.		At home.	
		Number.	Per ct.	Number.	Per ct.	Number.	Per ct.		Number.	Per ct.	Number.	Per ct.	Number.	Per ct.
6 to 9 years	845	2	.3	732	86.6	111	13.1	1,181	97	8.2	518	43.9	566	47.9
10 and 11 years								754	379	50.3	266	35.3	109	14.4
Total, 6 to 11 years	845	2	.3	732	86.6	111	13.1	1,935	476	24.6	784	40.5	675	34.9
12 and 13 years	400	48	12.0	336	84.0	16	4.0	1,084	952	87.8	90	8.3	42	3.9
Total, 6 to 13 years	1,245	50	4.0	1,068	85.8	127	10.2	3,019	1,428	47.3	874	29.0	717	23.7
14 and 15 years	624	523	83.8	82	13.1	19	3.1	1,072	1,031	96.2	20	1.9	21	1.9
Total, 6 to 15 years	1,869	573	30.7	1,150	61.5	146	7.8	4,091	2,459	60.1	894	21.9	738	18.0

It is seen that the per cent. of these at work, at school, and at home varied greatly in the two sections, not only for the children as a whole, but in the several age groups. Naturally the per cent. at work increases very greatly in the age group where employment was permitted under the law, namely, at 14 in New England and at 12 in the South.

Information was secured as to school attendance and ability to read and write of the women and children at work in all the cotton mill families visited except a few in North Carolina. The facts are shown in the following table:

ILLITERACY AND SCHOOL ATTENDANCE OF WOMAN AND CHILD WORKERS IN COTTON-MILL FAMILIES VISITED.

(This table does not include data for women and children in a few families in North Carolina.)

State and age group.	Total number.	Number reporting as to literacy.	Persons unable to read and write.					Persons able to read and write.		
			Number.	Per cent. of those reporting.	Persons who never attended school.	Persons who attended school.		Number.	Per cent. of those reporting.	Average months' school attendance.
						Number.	Average months' attendance.			
Maine:										
Children under 14 yrs.	30	29	4	13.8	.....	4	12.0	25	86.2	43.2
Children 14 and 15 yrs.	125	125	24	19.2	*a*3	*a*20	22.2	101	80.8	*a*50.7
Women 16 years and over	213	213	23	10.8	*b*2	*b*19	38.3	190	89.2	58.6
New Hampshire:										
Children under 14 yrs.	2	2	.....	.0	.....	.....	.....	2	100.0	(*c*)
Children 14 and 15 yrs.	48	48	1	2.1	.....	1	36.0	47	97.9	64.4
Women 16 years and over	89	89	9	10.1	2	7	24.9	80	89.9	62.1
Massachusetts:										
Children under 14 yrs.	1	1	1	100.0	1	.....	.....	.....	.....	.....
Children 14 and 15 yrs.	242	239	4	1.7	1	3	52.3	235	98.3	*d*63.0
Women 16 years and over	486	486	44	9.1	*b*24	*b*18	44.1	442	90.9	*e*62.4
Rhode Island:										
Children under 14 yrs.	17	17	1	5.9	1	.....	.....	16	94.1	34.6
Children 14 and 15 yrs.	108	108	8	7.4	4	4	19.5	100	92.6	*a*50.7
Women 16 years and over	229	229	24	10.5	20	4	15.8	205	89.5	*f*50.3
Virginia:										
Children under 14 yrs.	54	54	38	70.4	10	28	10.7	16	29.6	18.9
Children 14 and 15 yrs.	45	45	26	57.8	7	19	7.6	19	42.2	20.8
Women 16 years and over	52	52	25	48.1	11	14	9.7	27	51.9	*b*26.0
North Carolina:										
Children under 14 yrs.	438	327	176	53.8	*a*70	*a*105	6.6	151	46.2	*d*17.3
Children 14 and 15 yrs.	325	254	101	39.8	*a*33	*a*67	7.3	153	60.2	*g*19.5
Women 16 years and over	401	304	80	26.3	33	47	6.5	224	73.7	*h*20.2
South Carolina:										
Children under 14 yrs.	467	463	233	50.3	*d*109	*d*121	7.7	230	49.7	*i*22.3
Children 14 and 15 yrs.	279	276	88	31.9	*b*44	*b*42	6.9	188	68.1	*i*25.0
Women 16 years and over	328	326	74	22.7	34	40	8.8	252	77.3	*f*28.4
Georgia:										
Children under 14 yrs.	206	206	88	42.7	*a*28	*a*59	8.9	118	57.3	*f*19.6
Children 14 and 15 yrs.	209	209	59	28.2	14	45	10.6	150	71.8	*f*22.2
Women 16 years and over	276	276	65	23.6	22	43	10.5	211	76.4	23.9
Alabama:										
Children under 14 yrs.	146	145	95	65.5	42	53	6.5	50	34.2	*b*17.5
Children 14 and 15 yrs.	114	114	53	46.5	24	29	6.3	61	53.5	*b*21.0
Women 16 years and over	154	154	59	38.3	30	29	8.6	95	61.7	*b*17.4
Mississippi:										
Children under 14 yrs.	117	116	51	44.0	9	42	6.3	65	56.0	*b*13.5
Children 14 and 15 yrs.	59	59	13	22.0	6	7	4.7	46	78.0	*a*20.6
Women 16 years and over	77	77	8	10.4	4	4	7.3	69	89.6	27.2

a Not including 1 person, school attendance not reported.
b Not including 2 persons, school attendance not reported.
c Not reported.
d Not including 3 persons, school attendance not reported.
e Not including 22 persons, school attendance not reported.
f Not including 4 persons, school attendance not reported.
g Not including 8 persons, school attendance not reported.
h Not including 9 persons, school attendance not reported.
i Not including 5 persons, school attendance not reported.

Persons claiming to be able to write even a little were not counted as illiterate. Like all other tables in regard to illiteracy, this one may have a considerable element of error, due to untruthful answers to the inquiries. This margin, however, is certainly in the direction of understatement of illiteracy rather than overstatement.

A comparison of the percentage of illiteracy in the three age groups shows in each of the Southern group of States a greater percentage of illiteracy in the lower age groups than in the high ones. The differences, moreover, are pronounced enough to indicate that the children under 14 years of age have not attended schools to as great an extent as have the older mill workers. This is confirmed also by the average months of school attendance both of the illiterates and of those reporting themselves as able to read and write. Among the illiterates in nearly every case the average months of school attendance of the children under 14 at work are less than those of the women 16 years of age and over. Among those reporting themselves able to read and write, the difference as to months of school attendance is quite pronounced in every State save Alabama.

SCHOOL ATTENDANCE AND LITERACY OF CHILDREN UNDER 14 YEARS OF AGE AT WORK, IN COTTON-MILL FAMILIES IN NEW ENGLAND GROUP AND IN EACH STATE IN SOUTHERN GROUP, BY AGES.

Age.	Persons reporting as to school attendance.			Persons reporting as to literacy.				
	Number who never attended school.	Attended school.		Number.	Able to read and write.		Not able to read and write.	
		Number.	Average months.		Number.	Per cent.	Number.	Per cent.
NEW ENGLAND GROUP:								
10 years	.....	1	50.0	1	1	100.0	.....	.....
11 years	.....	.....	.....	1	1	100.0	.....	.....
12 years	.....	7	38.6	7	7	100.0	.....	.....
13 years	2	37	36.8	40	34	85.0	6	15.0
Total	2	45	37.4	49	43	87.8	6	12.2
Virginia:								
10 years	.....	6	9.2	6	.....	.....	6	100.0
11 years	2	3	8.3	5	1	20.0	4	80.0
12 years	3	18	15.4	21	9	42.9	12	57.1
13 years	5	17	14.4	22	6	27.3	16	72.7
Total	10	44	13.7	54	16	29.6	38	70.4

SCHOOL ATTENDANCE AND LITERACY OF CHILDREN UNDER 14 YEARS OF AGE AT WORK, IN COTTON-MILL FAMILIES IN NEW ENGLAND GROUP AND IN EACH STATE IN SOUTHERN GROUP, BY AGES—CONCLUDED.

Age.	Persons reporting as to school attendance.			Persons reporting as to literacy.				
	Number who never attended school.	Attended school.		Number.	Able to read and write.		Not able to read and write.	
		Number.	Average months.		Number.	Per cent.	Number.	Per cent.
North Carolina:								
7 years	1	.....	.....	1	.....	.....	1	100.0
8 years	4	3	4.3	8	3	37.5	5	62.5
9 years	4	12	9.9	16	4	25.0	12	75.0
10 years	5	15	7.0	18	6	33.3	12	66.7
11 years	15	33	8.5	49	15	30.6	34	69.4
12 years	21	82	12.6	103	54	52.4	49	47.6
13 years	23	112	15.6	132	69	52.3	63	47.7
Total	73	257	12.8	327	151	46.2	176	53.8
South Carolina:								
7 years	1	.....	.....	1	.....	.....	1	100.0
8 years	3	5	5.6	8	.....	.....	8	100.0
9 years	13	14	5.9	27	2	7.4	25	92.6
10 years	15	46	14.4	61	27	44.3	34	55.7
11 years	22	68	14.9	93	37	39.8	56	60.2
12 years	25	100	20.3	128	78	60.9	50	39.1
13 years	30	113	18.2	145	86	59.3	59	40.7
Total	109	346	17.0	463	230	49.7	233	50.3
Georgia:								
6 years	1	.....	.....	1	.....	.....	1	100.0
9 years	1	1	6.0	2	1	50.0	1	50.0
10 years	2	5	8.2	7	3	42.9	4	57.1
11 years	5	28	14.0	34	21	61.8	13	38.2
12 years	6	56	15.8	63	33	52.4	30	47.6
13 years	13	83	17.3	99	60	60.6	39	39.4
Total	28	173	15.9	206	118	57.3	88	42.7
Alabama:								
7 years	1	.....	.....	1	.....	.....	1	100.0
8 years	2	.....	.....	2	.....	.....	2	100.0
9 years	1	1	14.0	2	.....	.....	2	100.0
10 years	7	9	8.0	16	1	6.3	15	93.7
11 years	5	14	11.5	21	5	23.8	16	76.2
12 years	13	43	11.6	56	24	42.9	32	57.1
13 years	13	34	12.9	47	20	42.6	27	57.4
Total	42	101	11.7	145	50	34.5	95	65.5
Mississippi:								
7 years	1	2	1.5	3	.....	.....	3	100.0
8 years	.....	5	3.8	5	.....	.....	5	100.0
9 years	2	10	5.7	12	4	33.3	8	66.7
10 years	1	11	6.5	12	6	50.0	6	50.0
11 years	2	24	9.6	26	14	53.8	12	46.2
12 years	2	24	12.3	26	19	73.1	7	26.9
13 years	3	30	14.7	32	22	68.8	10	31.2
Total	11	106	10.5	116	65	56.0	51	44.0
Southern Group:								
6 years	1	.....	.....	1	.....	.....	1	100.0
7 years	4	2	1.5	6	.....	.....	6	100.0
8 years	9	13	4.6	23	3	13.0	20	87.0
9 years	21	38	7.3	59	11	18.6	48	81.4
10 years	30	92	10.9	120	43	35.8	77	64.2
11 years	51	170	12.4	228	93	40.8	135	59.2
12 years	70	323	15.5	397	217	54.7	180	45.3
13 years	87	389	16.4	477	263	55.1	214	44.9
Total	273	1,027	14.4	1,311	630	48.1	681	51.9

Of the 47 New England children reported as to school attendance, 45 had attended an average of 37.4 months, while 2 had never attended school. Of 1,300 such children in the South, 1,027 had attended an average of 14.4 months, while 273 had never attended school. Of 49 New England children reported as to literacy, 6, or 12.2 per cent., were unable to read and write. Of 1,311 such children in the South, 681, or 51.9 per cent., were unable to read and write.

The report of the United States Commissioner of Education for 1909 shows that the average number of days the public schools were kept open during the year was 194 in Rhode Island, 188 in Massachusetts, 159 in New Hampshire, 136 in Maine, 132 in Georgia, 130 in Virginia, 119 in Mississippi, 113 in Alabama, 98 in North Carolina, and 96 in South Carolina.

XI. Reasons Assigned for Employing Children.

A reason assigned by some manufacturers for the employment of children is their adaptability to certain occupations, particularly ring spinning and doffing. However, leading manufacturers who were interviewed during the investigation, while admitting that child labor was profitable and claiming that on account of the scarcity of labor it was necessary, alleged that it was not so profitable as adult labor. Young children tire out more quickly than older people and are unable to do their best work during the entire day. Their attention is more easily diverted from their work. As spinners, they do not so closely watch their machines to piece together the threads which break. The broken thread winds around the rollers and has to be pulled or cut off, making waste, which must again pass through the picker, cards, and other machines, and in going through them the second time the fibres are broken, and the yarn so made is not so good as yarn which is not partly made of waste. When threads are broken the manufacturer suffers a loss not only on account of an inferior product but on account of a loss of production of the spindles on which the threads break. Spinners, whether young or old, receive the same piece rate per side of a spinning frame, and for reasons stated it is natural that manufacturers would prefer older spinners if enough of them could be obtained.

The assertion frequently made that because of their size young boys are better adapted for doffing than older persons receives no support from the fact that in the mills visited in New England practically no doffers were found below 14, and only 23.6 per cent. of the total number were below 16, or from the fact that in every State visited in both New England and the South doffers over 16 earned higher average wages than doffers below that age. Doffers are usually paid by the day, and the higher average wages of those over 16 indicate that they are more efficient than those who are younger. As to ring spinners, it is significant that 48.2 per cent. of such spinners in the mills visited in the South, and 86.7 per cent. in the mills visited in New England, were over 16 years old.

Another reason assigned by manufacturers for the employment of children, though their labor may not be so profitable as that of older persons, is that while young they can acquire a dexterity and deftness in handling fine threads that cannot be acquired after the fingers become stiff. Nothing was developed by the investigation, however, to show that the operatives in the South are more efficient than those in New England though the age of beginning work is usually lower in the South than in New England.

The chief reason for the employment of children seems to be the short supply of labor. Many Southern manufacturers who were interviewed declared that they could not secure all the labor they needed, and that if workers below 14 were excluded from the mills there would necessarily be much idle machinery. All departments of a mill are dependent on the spinning room, and if the force in that room were reduced, there would necessarily be idle machinery and loss of production. It is further argued that if children below 14 were excluded many families having such children would leave the mills and return to the farms or mountains, and thus the mills would lose the labor not only of such children, but also of many adults in the same families.

During the last 30 years there has been a phenomenal development of cotton manufacturing in the South. In 1880 the number of spindles in Southern mills was 500,000; in 1890, 1,600,000; in 1900, 4,300,000; in 1905, 7,500,000; in

1908, 10,400,000.* This enormous increase in the industry has caused great demand for labor in the cotton mills. Southern mill owners want foreigners as workers, and in 1906 manufacturers in South Carolina contributed $30,000 to a fund appropriated by the legislature to pay the expenses of soliciting Belgians and other people in Northern Europe to emigrate to that state, and to pay their passage money to Charleston. The steamer *Wittekind* brought 450 immigrants from Bremen, and they were given employment mostly in cotton mills They became discontented, however, and some returned to Europe while others went to other States. At the time of the investigation in 1907–8, few of these people were found in the mills of South Carolina or of other Southern States. Owing to more stringent restrictions concerning the bringing over of immigrants imposed by the national immigration law, which became effective July 1, 1907, practically all efforts to induce foreign immigration into the Southern States were then suspended.

Undoubtedly the principal reasons why foreigners who are working in New England cotton mills cannot be induced to go to the South and work in the mills there are that the wages are much lower and working hours much longer in the South. This probably more than offsets the advantage in cost of living which is less in the South than in New England. No relief to the labor situation in Southern mills may, therefore, be expected from the North until the Southern mills adopt a higher scale of wages.

Cotton manufacturers in the South enjoy advantages over those in New England, not only in being permitted by law to employ younger children and to employ them for longer working hours, but also in the matter of paying lower rates of wages. Moreover, there is more water power available in the South, the price of raw cotton there is less, and Southern mill owners have entire freedom from interference by labor unions. Notwithstanding such advantages, the Southern manufacturers have been slow to support child labor legislation and in many cases have resisted it.

*The Southern States here included are Virginia, North Carolina, South Carolina, Georgia, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, and Texas. Arkansas included with all other States in 1908. Twelfth Census, Manufacturers, 1900, Part III, p. 49; also Census Bulletin No. 74, p. 51, and Census Bulletin No. 97, p. 12. These figures include cotton small wares in 1880 and 1890. They also overstate the growth of the industry between 1905 and 1908, as the figures for 1905 include spindles in cotton mills only and those for 1908 all cotton spindles.

CLASSIFICATION OF OCCUPATIONS.

THE CLASSIFICATION OF OCCUPATIONS, WITH SPECIAL REFERENCE TO THE UNITED STATES AND THE PROPOSED NEW CLASSIFICATION FOR THE THIRTEENTH CENSUS REPORT ON OCCUPATIONS.

BY ALBA M. EDWARDS, *Special Agent, Bureau of the Census.*

I. PAST ATTITUDE TOWARD OCCUPATION STATISTICS.

Until the last few decades the attitude of the leading nations toward occupation statistics has been one of neglect. While England and Wales began taking censuses of occupations in 1801, the United States in 1820, and Belgium in 1846, many of the other nations did not begin to perform this important social service until after the middle of the last century. Except in England and Wales, it was well past the middle of the century before anything important was done in the way of classifying occupations for census purposes; and the century was nearing its close before any of the national censuses of occupations could be said to be fairly reliable. The idea that not much could be made of occupation statistics prevailed quite generally. Then, too, with commercialism as an ideal, attention was centered on the *product* and not on the *producers*. As a result of this attitude, while national statistics of manufactures, of commerce, and of trade were being developed rapidly, statistics of occupations remained unsatisfactory, they were poorly classified and poorly reported, and they gave little aid to students of social and social-economic problems.

This attitude toward occupation statistics and their classification was unfortunate, for no statistics are more important than statistics of occupation. The *raison d'être* of all statistics is to aid man in his study of man and man's environment; and the ultimate purpose of all statistics is to better the social and economic condition of man. Our ultimate concern is not whether we are producing more corn and wheat, or increasing our exports to foreign countries, or building more miles of

railroad; but whether we are producing better, and healthier and happier farmers, and sailors, and railroad laborers. In other words, our ultimate concern is not about the *product* and its *quantity*, but about the *producers* and their *quality*. Whether the changes in production, distribution, and exchange, suggested or dictated by our statistics of manufacturers, of transportation, and of trade, have been successful, can be determined, finally, only by recourse to social statistics—to the statistics which measure the social and economic status of the workers. Therefore, no statistics have a better reason for existing and for claiming our attention than statistics of occupation, for occupation is the best single criterion of a man's social and economic status.

Whether the problem under consideration be one of those which affect mainly the working classes—the problems of child labor, woman labor, accident risks and indemnities, insurance benefits, labor legislation, etc.—or whether it be one of those which affect society at large—the problems of health, intemperance, morality, crime, pauperism, marriage and divorce, immigration, the negro question, etc.—its solution necessitates a careful consideration of occupations. For example, in the study of the problem of immigration we desire to know not only into what industries the immigrants go, but also what positions they take in these industries—whether they are at the bottom, or at the top, or midway between. And the children of the immigrants—do they enter the same industries as their parents, and the same occupations, or do they enter higher industries, or higher occupations in the same industries?

Certain inherent difficulties make absolutely accurate occupation statistics impossible. Apart from the difficulties common to all census inquiries—such as that of securing, training, and supervising a perfectly efficient body of enumerators, and that of securing absolutely accurate statements from persons who are ignorant, indifferent, or not trained in making accurate statement—there are two which arise from the nature of the inquiry. They are:

(1) The impossibility of making a classification of occupations sufficiently broad and sufficiently detailed to cover all

the various activities of the millions of gainful workers in a country with a great diversification of industries and with minute division of labor in each industry.

(2) The impossibility of classifying with complete accuracy occupations which in reality are not clear-cut and well defined. Formerly, under the guild system, to a large degree each man had a definite occupation or trade, as, cooper, tailor, shoemaker, etc.; but with the transition to the factory system and the great division of labor which accompanies it, the tendency has been for each of these old handicraft trades to give place to a number of specific processes in the manufacture of the same article. The transition is still in progress, so that, today, a workman may make the whole of an article, or perform several of the processes in its manufacture, or only one of them. Moreover, the nature of the processes is changing continually. This indefiniteness in certain occupations makes their accurate return and classification impossible; and this indefiniteness will remain so long as new processes in manufacturing are being devised.

While the inherent difficulties of enumeration are greater for occupation statistics than for most other census statistics, and while the inherent difficulties of classification are greater than for most of the others, very similar difficulties are met with in the classification of manufactures—the difficulties due to the great complexity of modern industrial establishments and processes. We may conclude, then, that, although there are certain inherent difficulties in the way of securing their absolute accuracy, the attitude that not much can be made of occupation statistics is wrong, and that, were the non-inherent difficulties eliminated, and were the same care and study given to these as has been given to statistics of manufactures and trade, they would become sufficiently accurate for most practical purposes.

In recent years, a change in the attitude toward occupation statistics has been taking place—a change due partly to the growing interest in statistics in general, but, mainly, to the increased interest in social problems and in their statistical measurement. Students of social problems have come to see that the statistics which inform them as to the actual life conditions of one half of the population for one third of each

working day, and which give them a fairly reliable index to their life conditions for the balance of the time—as well as giving them a fairly reliable index to the life conditions of those dependent upon this one half—are far too important to be neglected. But the very effort to utilize such statistics more fully has shown that they are deficient in quantity, too often are defective in quality, and seldom are classified in any satisfactory manner.

II. Proper Basis for Classifying Occupations.

The value of occupation statistics in the study of social problems is dependent very largely upon the form in which the occupations are classified. Therefore, the basis of classification is of prime importance. However, the proper basis can be determined only when we have clearly in mind the purpose of occupation statistics.

It should be the purpose of statistics of occupation and their analysis to give a vivid picture of the occupational position of each and every worker. With this end in view, they should show, so far as possible, not only the skill and intelligence of the worker, and his position in the industry, as employer, employee, or working on his own account, but, as a means for the study of the risk, healthfulness, and numerous other problems connected with his occupation, they should show, also, the specific services rendered, work done, or processes performed by him.

Therefore, occupations should be classified with respect to the kind of work done or the character of the service rendered, rather than according to the article made or worked upon, or the place where the work was done. The worker and his work should be their basis, and not the industry and its product. The industry and its product have no place in an occupation classification, except as they are aids in showing more clearly and exactly the occupational positions of the different workers. As such aids, they do perform an important service, but they should never be made the *basis* of the classification.

It is very important that the distinction between the purposes of occupation and industrial censuses, respectively, be kept clear. The purpose of a census of occupations is to show

the *kind of labor*, while, in a census of industries, the purpose is to show the *result of the labor*. The one is concerned with the *workers*, the other with their *product*. *Occupation statistics* should show individuals according to their personal occupations, without any *special* consideration of the industries in which they carry on their occupations. The division of individuals by industries is a matter of *industrial statistics*. Moreover, occupation statistics should not duplicate the statistics of manufactures, agriculture, mining, etc., but should supplement them and be supplemented by them.

III. Occupation Classification in Europe.

No foreign classification examined * measures up to this ideal. In the censuses of the leading nations of Europe, the classification of occupations has been according to an industrial rather than a personal or occupational form. Persons in the same industry have been classed together, rather than the persons who followed the same occupation. It is true that usually there is a subdivision of the personnel of each industry, according to position in the industry as employers, employees, working on own account, etc., and that, in a few countries, there is a further subdivision of the personnel of each industry into a few large occupational groups or strata, as proprietary, supervisory, clerical, etc., but in no classification studied is there any attempt to classify all the workers in each industry according to their respective specific occupations. Thus, these censuses have not been strictly censuses of occupations, but rather combinations of occupational and industrial censuses.

In the classification of the occupations in public, professional, and domestic and personal service—the non-industrial occupations—the foreign classifications are at their best, and, in some cases, the classification of these occupations is quite satisfactory. This seems to be due, however, rather more to the ease with which such occupations can be classified than to the merits of the classifications followed. The proper classification of the industrial occupations, especially those in manufacturing and mechanical industries, is most difficult, and every classification of occupations shows its strength or

* Those of England and Wales, France, Germany, Austria, Belgium, Switzerland, and Italy.

weakness at this point. Therefore, in the preceding and in the following criticisms of European classifications reference is made mainly to the classification of industrial occupations.

In the census of England and Wales (1901) the service occupations are well classified, and, in general, the classification of commercial occupations is not objectionable. However, we find here these composite groups: "Bankers; Bank Officials, Clerks"; "Insurance Officials and Clerks"; "Railway Officials or Clerks"; and "Telegraph, Telephone-Service." Under "Mines," the 640,989 coal mine operatives are divided into only three groups, and there is no division of the 789 workers in copper mines, or of the 6,577 tin miners, or of the 4,375 lead miners. Under "Metals, Machines, Implements, and Conveyances," only the followers of skilled occupations are reported separately under their respective specific occupations. The other workers are reported under such inclusive headings as, "Pig-Iron Manufacture (Blast Furnaces)" (12,-742); "Puddling Furnaces and Rolling Mills" (42,422); "Steel Smelting and Founding" (30,738); "Tinplate Manufacture" (13,048); "Lead Manufacture" (1,363); "Nail Manufacture" (3,163); "Stove, Grate, Range, Fire Iron-Makers" (5,989); "Tinplate Goods Makers" (22,100); "Cycle and Motor Manufacture" (28,537). The workers in the glass industry are divided as follows: "Sheet, Plate-Glass Manufacture" (5,257); "Glass Bottle Manufacture" (10,591); "Other Workers in Glass Manufacture" (11,870). "Paper Manufacture" is the designaton for the occupations of 15,359 workers. While, under "Textile Fabrics," the classification of the cotton workers, the wool and worsted workers, and the silk workers is fairly good, there is no division according to occupation of the 6,881 "Rope, Twine, Cord-Makers," or of the 13,893 persons engaged in "Hosiery Manufacture," or of the 12,632 persons engaged in "Lace Manufacture," or of the 7,150 persons engaged in "Carpet, Rug, Felt, Manufacture." There are 174,806 "Boot, Shoe-Makers," and 119,515 "Tailors."

Although the workers in each of the above groups are subdivided, according to position in the industry, into "Working at Home," "Employers," "Working for Employers," "Working on own Account," and "Others or no Statement," it is

very evident, that, in general, specific occupations are not given, and that, on the whole, the classification of England and Wales is industrial and not occupational in form.

In the census of France of 1906 there is an utter confusion of *products* and *producers*. While in many cases specific occupations are given, in the majority of cases only the industry in which the person works, or the name of the article he produces, is given. Examples are: "Biere" (22,861); "Boulangerie" (174,165); "Papier" (27,306); "Lingerie" (132,052); "Chaussures" (192,934); "Meubles" (55,828); "Cuivre" (4,984); "Plomb" (706); "Zinc" (2,932); "Vélocipèdes" (15,898); "Automobiles" (21,670); "Porcelaine" (12,222); "Bouteilles de verre" (15,964). In the long list of subdivisions, for each of which separate figures are given, probably there are more than 2,000 names of industries, and occupations, and articles—all curiously intermingled. The workers in each of these subdivisions are further subdivided, according to position in the industry, into "Chefs," "Employés," "Ouvriers," "Employés et Ouvriers sans Emploi," and "Isoles." Notwithstanding the large number of subdivisions in the French classification the articles worked upon have stood for the workers too generally for it to be called a classification according to occupations.

The meritorious forms for classifying occupations for general census purposes may be put into two groups. In the first group belong the different schemes for classifying workers in detail, each according to his specific occupation. In the second group belong the different schemes for dividing workers into occupational groups or strata, according to skill or according to some other occupational feature, which those to be put into each respective group are supposed to possess in common.

Each of these two forms for classifying occupations—the detailed occupational form, and the group form—has its merits and its defects. The chief merits of the group form over the detailed occupational form are: (1) The greater ease with which the numerous, and often indefinite, occupation returns can be classified into a few large groups than into many specific occupations; (2) the probable greater reliability of the resulting group figures, since the fewer the lines of division the less the chance of putting an occupation into the

wrong class; (3) the greater ease with which the figures for a few large occupation groups can be reported, than can the figures for numerous specific occupations; (4) the greater convenience of the group form of statistics in the study of social questions involving only the consideration of broad occupational groups or strata.

The German probably is the best example of the group form of occupation classification. In the German census of 1907 this form is highly developed—so well developed, in fact, that it is very doubtful whether any other classification now in use equals it. Category "B," which includes the manufacturing, mining, and building industries, is divided into 165 divisions; and each of these divisions is further subdivided into as many of the following 10 groups as are applicable:

1. Proprietors and partners.
2. Lease-holders.
3. Superintendents.
4. Contractors who carry on industries in their own dwellings for others.
5. Technically trained officials.
6. Foremen and overseers.
7. Clerical persons—bookkeepers, copyists, etc.
8. Members of the proprietor's family who are engaged in his business as helpers.
9. Skilled occupations for which as a rule apprenticeships are necessary.
10. Other helpers and handworkers for whose occupations apprenticeships usually are not necessary.

While the German classification is an excellent example of the group form, and while from many standpoints it is quite satisfactory, it is defective in that it does not serve all the purposes a national census of occupations should serve. It would be deficient as an aid in any study in which it would be necessary to consider specific occupations in detail. Group 8, above, is not a division according to occupation, but according to social status or blood relationship. In fact every person included in this group must, occupationally, belong in one or another of the other groups. Each of the groups 9 and 10 is too inclusive for the work conditions of the persons included to be the same, and in each the classification is according to skill

rather than according to occupations. Thus, the German classification is unsatisfactory as a group classification according either to skill or to the similarity of the work conditions of the members of each respective group.

The classifications of Austria and Belgium follow the same group form as does the German classification; but neither of them is so well developed a type of this form. Category "B" of the Austrian census of 1900, including the mining, manufacturing, and building industries, is divided into 112 groups, and each of these groups is further subdivided as follows:

1. Proprietary.
2. Supervisory, scientific, technical, and clerical.
3. Workers or operatives (except day wage workers).
4. Day wage workers and laborers not otherwise specified.
5. Members of the proprietor's family who are helping him in his business.

Except for this general grouping, the Austrian classification is almost entirely industrial; and, although in some cases specific occupations or trades are given, in general, for industries such as "Schiffbau," "Maschinen, Werkzeuge, Apparate," and "Glasfabrikation," the above are the only subdivisions of the workers.

In the Belgian census of 1900 there are about 150 subdivisions under mining, manufacturing and building. Each of these subdivisions is further subdivided as follows:

1. Masters.
2. Technical employees.
3. Supervisory persons.
4. Operatives.

Except for this grouping, the classification of the personnel of industrial establishments is mainly industrial. A very large proportion of the stub lines begin with "Fabrication de ———," Confection de ———," or "Préparation de ———;" and, usually, all the "ouvriers" of an industry are lumped together, without regard to differences in skill, work conditions, etc. The following are examples:

"Exploitation des mines de houille" (ouvriers, 138,576);

"Industries metallurgiques ayant pour object la fabrication ou le traitement du plomb, du cuivre, du zinc, du nickel, des métaux précieux, etc." (ouvriers, 12,081);

"Fabrication et réparation de dentelles" (ouvriers, 61,553); "Confection d'articles de tailleur, de tailleuse, de giletier et de costumier" (ouvriers, 90,190).

In the Swiss census of 1900, the industrial form of classification is followed completely.* There are 165 divisions under mining, manufacturing, and building, and each of these divisions is the name of an industry. The personnel of each industry is further subdivided, according to position in the industry, as follows:

1. Persons working on their own account.
2. Supervisory, technical, and clerical persons.
3. Operatives whose occupations are peculiar to the industry.
4. Operatives whose occupations are not peculiar to the industry.
5. Helpers and "personnel subalterne."
6. Apprentices.
7. Not specified.

Since the Swiss "Bureau de Statistique" has frankly acknowledged the defects of its classification† and pointed out the superior merits of a classification showing both the specific occupations of the workers and the industries in which they are employed, and since it has recognized the necessity of greater occupation detail at its next census, further criticism here is unnecessary.

In the Italian census of 1901, we have an attempt to classify workers according to their specific occupations. The scheme for an international classification which was approved by the International Institute of Statistics at its Christiania session was followed, after being modified slightly in order to make possible comparisons with the two preceding Italian censuses.‡ There are 166 divisions under mining and quarrying, manu-

* "Conformément au procédé adopté pour les recensements précédents, la distinction des professions n'a pas eu lieu suivant le genre particulier de *travail personnel*, mais avant tout d'après le *but industriel* de l'entreprise."—Recensement Fédéral, Troisième Volume, p. 7.

† "Il est à peine besoin de faire remarquer avec quelques détails que, pour connaître une population, la double distinction des individus selon le genre d'occupation et selon le but et les produits du travail a une valeur réelle et toute particulière. La distinction etablie d'après la nature de l'occupation permet mieux de reconnaître et d'étudier l'influence des diverses professions sur la mortalité au sein de la population; d'un autre côté, la distinction établie d'après le but de l'occupation et de la branche de l'entreprise se prête mieux à la solution des questions de législation industrielle, etc.; c'est pourquoi nous reconnaissons déjà ici la nécessité qu'il y aura, lors du prochain dénombrement, à recenser la profession personnelle de l'ouvrier à côté de celle de l'employeur."—*Ibid*, p. 8.

‡ Census of Italy, 1901, Vol. V, p. lxxv.

facturing and building. The workers included in each of these groups are further subdivided, according to position in the industry, as follows:

1. Masters and directors of establishments or operations, and artisans working on their own account or for others.
2. Clerks, bookkeepers, accountants, messenger boys, etc.
3. Technical employees, factory operatives, and day laborers.
4. Independent artisans in the textile industry.

It is hardly necessary to call attention to the composite character of group 3 above, or to the large percentage of the personnel of an industry which must be reported under this head, or to the great diversity in the skill of the persons included, or to the probable great differences in the conditions under which they work.

While the Director General of Statistics has given us evidence* that he has the proper idea as to what a census of occupations should show—the *kind of labor*, rather than the *kind of product*—an examination of the report will show that he has not been successful in carrying out this idea. Of the 166 divisions under mining and quarrying, manufacturing, and building, only about one in three can be construed as being names of occupations. Many of them begin with "Fabbricanti di ———," and fully two thirds of them can more properly be called names of industries or of industrial processes than of occupations. Thus, in many cases, this is a classification according to the *material* worked upon, or the article dealt in or handled. In Italy, where hand trades are still quite prevalent, it may designate a worker's occupation sufficiently to state the material upon which he works, or the article which he deals in or handles; but in countries where the industrial organization is more highly developed, and where hand trades have very largely given place to factory production with its minute divisions of labor and processes, it is not by any means a sufficient description of a worker's occupation to state the material upon which he works, or the article he deals in or handles.

* "Infine conviene aver presente che in un censimento delle professioni, si ha riguardo al genere di lavoro, ossia al modo col quale si applicano alla produzione i singoli individui: invece, in una statistica industriale, si ha di mira piuttosto il risultato finale, ossia la specie di prodotto ottenuto."—Census of Italy, 1901, Vol. V, p. lxxvii.

IV. Bertillon's Scheme for an International Classification.

Recognition of the importance of scientifically gathered and arranged national statistics has come only with the increased study and use of statistics and of statistical methods of measurement and comparison. So long as each country existed largely as an independent social and industrial unit, and so long as there was no attempt to make a scientific study of social and economic problems, little need was felt for systematic and detailed statistics. But when students and statisticians began to study social and economic problems scientifically, and as world problems and world movements, they at once found need not only for accurate and detailed national statistics, but also for international statistics, or at least for the data from which such statistics could be compiled. It was soon discovered, however, that not only were the statistics of individual countries often defective, poorly arranged, and lacking in detail, but that the lack of uniformity in the classification of the statistics of the different countries was so great as to all but preclude any comparisons. In fact, to-day, any comparison of the statistics of two countries must be offered with an apology and an explanation; and only the trained statistician is safe in attempting to make such a comparison. Dr. Robert Giffen has shown how difficult it is to make any international comparison of the statistics on such important subjects as education, crime, sexual morality, drunkenness, bankruptcy or insolvency, diffusion of property, agricultural production, manufacturing production, imports and exports, wages, and aggregate wealth.*

Although the great need of uniformity in the classification of national statistics is now generally recognized,† little has been done to bring about such uniformity in the classification of occupation statistics. The only effort of importance along this line is that fathered by Dr. Jacques Bertillon. It has for its object the general adoption and use by the nations of an international classification of occupations. Doctor Bertillon, as far back as 1889, at the session of the International

* Pub. Am. Statist. Ass'n., 1892, Vol. III, pp. 199–212.

† "Half the value of a census is wantonly wasted unless it is so planned that there can be read out of it not only the facts that concern the nation taking it, but the meaning of those facts when interpreted by the experience of others."—S. N. D. North, Pub. Am. Statist. Ass'n, 1908.

Institute of Statistics in Paris, submitted outlines of a system for the uniform classification of occupation statistics, and placed before the next session (Vienna, 1891) a completely worked out "international occupation scheme." This scheme, with some changes made to render it more agreeable to more than a score of directors of the leading statistical bureaus of Germany, Austria-Hungary, Belgium, France, Great Britain, Italy, Norway, and Sweden, to whom it had been submitted for criticism, was adopted by the Institute at its session in Chicago in 1893.*

Doctor Bertillon's classification contains, under its 4 categories, 12 general divisions, subdivided into 61 groups of related industries or related occupations. Of these 61 groups, as many as practicable are further subdivided into industries or groups of occupations, making 207 such divisions. Finally, as many as practicable of these 207 divisions are again subdivided, usually according to occupation, making a total of 500 such subdivisions.

Considering the enthusiasm with which this scheme for an international classification of occupations was launched by its author, its hearty acceptance by the International Institute of Statistics, the approval given it by the directors of many of the leading statistical bureaus of the world, and its superiority over the classifications then in use, until the last few years, it seems to have had less effect in practice than might have been expected and to have been discussed less by statistical and economic writers. A commission appointed to study methods for a census of occupations in France recommended that the classification adopted by the International Institute of Statistics be adopted for the census of 1896, but the advice of the commission was not followed. Two letters from Doctor Bertillon—dated December 18, 1909, and June 8, 1910, respectively—inform us that more interest is being taken in his classification at the present time. Prior to the date of his last letter, it had been adopted by Egypt for its last census (1907 and for its next, by Bulgaria for its last census (1900) and for its census of 1910, by Spain for its last census and for its census of 1910–1911, by Mexico for its census of 1910, by Venezuela for its census of 1910, by Brazil for its census of 1910,

* Bulletin de l'Institut International de Statistique, 1895, Tome 8, p. 226.

and by Chile for its next census. So far as learned, no other countries up to the present have seen fit to adopt the international classification.*

It is generally agreed that many of the existing national classifications of occupations are inadequate, illogical, and unscientific, and that, because of the great differences in the classifications used, as a rule accurate comparison of the statistics of two countries is not only impossible, but cannot be rendered possible by any slight modifications in their classifications. Would it be advisable, then, for the other nations to follow the lead of Italy, Egypt, Bulgaria, Spain, Mexico, Venezuela, Brazil, and Chile, and adopt the international classification?

The present world movement for international uniformity of regulations and legislation on subjects of international interest, and the present movement for the international co-operation and uniformity of methods of scientific and other learned societies shows us that, in all probability, sooner or later, international uniformity in the form of reporting national statistics will come. But it is still an open question whether, at that time, Doctor Bertillon's scheme for the classification of occupations will be the one adopted. While it is the best existing example of the occupational form of classification and a great improvement over the classifications now generally in use, it is not without its defects. In many respects it is a classification by industries rather than by occupations. Especially in the principal ones of its general divisions—"Agriculture," "Extraction of Minerals," "Manufacture," "Transportation," and "Trade,"—frequently the workers are classified according to what they make, rather than according to what they do—according to the *product* to which their services contribute, rather than according to the particular processes which they perform. For example, in the first general division of this classification, "Agriculture," it would be well to report the employees separately from the employers more than is done, and occupational designations might well be substituted for the terms "Fresh-water fish," and "Game." In the second general division, "Extraction

* In their meeting of 1910, the French members of the International Institute of Statistics passed a resolution approving Doctor Bertillon's classification, unanimously and without discussion.

of Minerals," the name of the minerals extracted, as "Coal," "Anthracite," "Peat," etc., are given throughout, and in no case the actual occupations of the workers, as blasters, laborers, foremen, etc. In the third general division, "Manufacture," sometimes occupations, as spinners, weavers, feather dressers, etc., are given, but in about two fifths of the cases only the names of the materials worked upon, as "Jute," "Laces," "Ivory," "Crockery," etc., are given. In the fourth general division, "Transportation," occupational designations are given, except in the cases of "Post," Telegraph," and "Telephone," but that these designations are not as detailed as might be desired is exemplified by the all-inclusive designations, "Ship owners and their employees, ship brokers," and "Railroad, directors, employees, workmen, agents of every sort." In the fifth general division, "Trade," generally occupations are given, but these are not as detailed as it is desirable to report them, and the general term, "Insurance companies of different kinds," is used in lieu of the individual occupations of the persons engaged in that business. In the sixth general division, "Public Force," the terms "Land Army," "Navy," "Gendarmery," and "Police," are used without further subdivision. Likewise, in the seventh general division, "Public Administration," all the numerous government officials, clerks, etc., are bunched together under the one general heading, "Service of the State." And in the eighth general division, "Liberal Arts," while in the main occupations are given satisfactorily, we find this rather too inclusive designation: "Professors [including teachers] of any title whatever in educational institutions maintained by the state, province, commune (primary schools, colleges, universities, etc.)."

Thus, the international classification is not a classification strictly according to occupations, or the kinds of work done but is partly occupational and partly industrial. This lack of consistency is a grave defect in any form of classification which purports to be a model for international adoption and use. It is a defect, however, which could be remedied by changes in Doctor Bertillon's "third classification"—the substitution of occupations for the materials worked upon—without destroying his general plan. With these changes, the

scheme would be an excellent one, and one that might well be adopted generally. In main outline it is far superior to many of the classifications now in use; and, with a proper classification of occupations under its twelve general divisions, it would give an excellent picture of the occupational distribution of the population of a country.

V. Occupation Classification in the United States.

Coming, now, to the United States, we find that it has not been an exception to the general rule. Until recent years there was the same negligent attitude toward occupation statistics that was prevalent among European nations. While the first federal census of occupations was taken in 1820, it was not until 1870 that anything of importance was done in the way of classifying occupations, and it was not until 1890 that the statistics of occupations could be said to be fairly reliable. The amount of space given to occupation statistics and their analysis in the reports of the censuses, prior to that of 1890, was comparatively small. In the reports of the census of 1890, more attention was given the subject, and in the reports of the census of 1900 a special volume of over 1,000 pages was devoted to "Occupations."

But notwithstanding the increased prominence given to occupation statistics at the census of 1900, they have failed to satisfy the rapidly increasing demands of the students of labor, social, and other problems for more accurate and detailed information about the occupations of the people. In order better to satisfy this demand, special attention is being given the subject of occupation statistics and their classification at this census (1910). At each preceding census, such a large percentage of the occupations were returned indefinitely that detailed classification was impossible. This was due partly to the fact that, although, in 1890 and again in 1900, the enumerator was expected to state both the kind of work done and the general nature of the business or industry, but a single column on the schedules was provided for the return of occupations. At this census (1910) two columns were provided for this purpose.* The instructions to enumerators were re-written and made more definite and more emphatic.

* An improvement made by Switzerland in 1880.

The classification, changed but little since 1890, and never satisfactory, was made the subject of special study.

A little study showed that the classification of occupations in the census of the United States needed a thorough overhauling. The classification of occupations in the Twelfth Census is practically that of the Eleventh Census, with some further division into minor occupation groups. In writing of the classification of occupations in the Eleventh Census Mr. Henry Gannett says:*

"There is probably no subject connected with the census concerning which there seems to be less clearness of purpose or plan than the classification of occupations. What the purpose of the statistics of occupations is, or the character of the information which such statistics are designed to present, is not made clear by any existing classifications." And, notwithstanding the attempt made in 1900 "to classify occupations with respect to the kind of work done or character of service rendered, rather than according to the article made or worked upon, or place where the work was done," Prof. John Cummings, writing in the *Journal of Political Economy*,† says of the classification of occupations in the Twelfth Census:

"It has often been pointed out that the general classification is, nevertheless, one by industries, and it will appear from an examination of the specific designation within these larger groups that the classification by industry, rather than by character of work, is carried out to considerable detail. These two principles of classification are obviously conflicting, and the resultant grouping is in consequence one of little significance; it is neither one of trades, crafts, or occupations, on the one hand, nor by industries, on the other, whether this is due to the inherent difficulty of applying universally any single principle of classification or not, it is certainly unfortunate, and vitiating."

Under the present classification, workers of various degrees of skill, or workers in occupations where the degree of healthfulness and safety varies much, often are grouped together merely because they work in the same industry. Thus, often, it is a classification by industries, rather than by grades of

* Pub. Am. Statis. Ass'n, 1894, Vol. IV, p. 12.

† Vol. II, p. 192.

workmen or kinds of work. For example, the most skilled glass blower is grouped with the laborers of the glass industry; the mine foreman and the ignorant and unskilled mine laborer are put in the same class; 203,220 "Iron and steel workers" are all grouped together regardless of the difference in skill and in healthfulness in the different occupations. Here are a few of the many other examples of unscientific grouping: the miller and the laborer about the mill; the highest and the lowest grades of saw and planing mill employees (150,612); all classes of piano and organ makers; the employees in many kinds of "not specified" woodworking industries; all the "Watch factory operatives"; the many occupations (nearly 100 were returned in the 1910 schedules) followed by the 246,391 cotton mill operatives; and all the occupations followed by the 73,196 woolen mill operatives.

The classification followed in the census of 1890 may have been the best practicable one for the United States at that time, and the statistics reported under it may have satisfied in a large degree the demands made upon the government for statistics of occupations; but it is believed that it is not the best practicable classification for the United States today, and it is certain that the statistics that could be reported under it would not meet the present demands on the government for statistics of occupations.

While it is generally agreed that a new and more detailed classification of occupations is necessary, it is not agreed as to what the form of the new classification should be. Some say we should give up the present form of classification, which, largely, is one by industries, and base the new classification principally on skill. Others contend that the new classification should be one of occupations only, and that no particular attention should be paid to industries or to skill.

A division of the gainful workers of the nation on the basis of skill and intelligence would go far toward showing the occupational station in life of each of them. In many respects such a classification would be an admirable and a useful one, but it is not without its difficulties and defects. Since there is no agreement as to which occupations are skilled, the person making a detailed classification according to skill must be acquainted with the skill required in each of the numerous

occupations in each of the various industries. No man, from his own experience, has such an acquaintance. To familiarize himself with the skill required in each of the occupations in each industry would be a very long and arduous, if not impossible, task.

A rough classification based on skill alone would be possible, but, aside from the practical difficulties already mentioned, which would be encountered in any attempt to carry it out, it has a number of grave defects. If, for example, all industrial and occupational distinctions were done away with and all the workers were grouped according to skill, regardless of the industries in which they worked or the specific kind of work they performed, it would be impossible to tell whether, with a given mortality rate for factory operatives, the operatives in all factories and in all factory occupations had the same mortality rate, or whether the rate was much higher in certain factories and in certain occupations than in others. But, by reporting in detail all the different occupations in each industry, any high rate due to exceptionally bad conditions in one industry or in one occupation could be traced to its source quickly. Again, while the skill and intelligence of all farm laborers may, in the main, be the same, yet the healthfulness of the occupation of the "cranberry-bog laborer" may be far different from that of the poultry-yard laborer or the vineyard laborer. The healthfulness of an occupation and the skill required in its pursuit have no necessary relation to each other.

A classification of workers according to their respective occupations would, in many respects, be a satisfactory one, since it would furnish the statistician or other student with data capable of being reclassified to suit his special purpose. But it is evident that, in practice, we could not follow a classification according to occupation alone, for the occupations are far too numerous, the distinctions between them frequently are too loose, and the returns of the enumerators are too imperfect. Since all the occupations in the cotton industry, for example, cannot be reported separately, how would those grouped together be reported if not as "Other workers in the cotton industry"?—thus, of necessity, resorting to an industrial classification.

Not only is it now impossible to report separately each of

the specific occupations in each industry, but this is becoming and will continue to become increasingly difficult as the number of our industries increases and as the division of labor in each industry becomes more and more minute. Even could the specific occupations be reported separately, often the number of persons in each occupation would be so small as to preclude generalization.

Since, then, it does not seem wise to ignore industries entirely and make a classification based alone or mainly on skill; since it is impossible, because of the large number of occupations and the insufficiency of the returns, to carry out a complete classification based on occupation only; and since it seems to be neither wise nor practicable to break away entirely from the industrial form of classification and thus render impossible the study in detail of the occupations in individual industries, and the comparison of Thirteenth Census occupation statistics with the occupation statistics of past censuses—since these things seem to be true, what form of classification should we adopt? Will it not be best to adopt a classification based principally upon occupation, and, so far as possible, still retaining the present industrial form? Can we not in this way retain what is best and essential in each method of classification and at the same time avoid such revolutionary changes as would render comparison with our past statistics impossible?

In the belief that an occupational classification, with an industrial framework, is the best form, a tentative scheme for such a classification has been formulated by the Bureau of the Census. The general outline of this classification—the industrial frame-work—is given below. The detailed manner in which the occupations in each industry are classified is shown later.

(A) EXTRACTIVE INDUSTRIES.

I. AGRICULTURE, FORESTRY, AND ANIMAL HUSBANDRY:
- Agriculture
- Forestry
- Animal husbandry

II. EXTRACTION OF MINERALS:

Mining.
- Coal mines
- Copper mines

Gold and silver mines
Iron mines
Lead and zinc mines
Other mines
Mine workers (mine not specified)

Quarrying.
Quarries (stone, cement, sand, clay, etc.)

Production of salt, oil, and natural gas.
Production of salt
Production of oil and natural gas

(B) Industries of Transformation, Transportation, and Trade.

III. MANUFACTURING AND MECHANICAL INDUSTRIES:

Building trades.
Building and hand trades

Chemicals and allied products.
Fertilizer makers
Paint makers
Powder, cartridge, dynamite, fuse, and fireworks makers
Soap makers
Other chemical workers

Clay, glass, and stone products.
Brickmakers
Potteries
Tile makers
Glass
Terra-cotta workers
Lime, cement, and gypsum
Marble and stone cutters

Clothing.
Clothing makers (suits, coats, cloaks, and overalls)
Clothing makers (other than suits, coats, cloaks, and overalls)
Corset makers
Glove makers
Hat makers (wool or felt)
Shirt, collar, and cuff makers

Food and kindred products.
Bakeries
Butter and cheese makers
Candy
Fish curers and packers
Flour and grain mills
Fruit and vegetable canners, picklers, and preservers
Slaughter and packing houses
Sugar makers and refiners
Other food preparers

Iron and steel and their products.
- Agricultural implements
- Automobile factories
- Car and railroad shops
- Foundries and metal working
- Iron and steel mills
- Ship and boat building
- Wagons and carriages
- Other iron and steel workers

Leather and its finished products.
- Harness and saddle makers and repairers
- Leather belt, leather case, and pocketbook makers
- Shoes
- Tanneries
- Trunk makers

Liquors and beverages.
- Breweries
- Distilleries
- Other liquor and beverage workers

Lumber and its remanufacture.
- Box makers (wood)
- Furniture
- Pianos and organs.
- Saw and planing mills
- Other woodworkers

Metals and metal products other than iron and steel.
- Brass mills
- Clock factories
- Copper factories
- Gold and silver workers
- Jewelry factories
- Lead and zinc factories
- Tin-plate factories
- Tinware factories
- Watch factories
- Other metal workers

Paper.
- Box makers (paper)
- Makers of blank books, envelopes, tags, paper bags, etc.
- Paper mills
- Pulp mills

Printing and bookbinding.
- Printing and publishing establishments

Textiles.
- Carpet mills
- Cotton mills
- Dyeing and finishing textiles
- Hemp and jute mills

Knitting mills
Lace and embroidery makers
Linen mills
Print works
Rope and cordage factories
Sail, awning, and tent makers
Silk mills
Woolen mills
Worsted mills
Not specified textile workers

Miscellaneous industries.

Broom and brush makers
Button makers
Charcoal and coke burners
Cigars
Electric light and power companies
Electrical supplies
Gas works
Oil works
Rubber factories
Straw workers
Tobacco
Turpentine distillers
Other miscellaneous industries and occupations
Workers in "Not specified" manufacturing and mechanical industries

IV. TRANSPORTATION:

Water transportation.

Water transportation

Road, street, and bridge transportation.

Construction and maintenance of streets, roads, sewers and bridges
Livery stables
Truck, transfer, cab, and hack companies
Street railways

Transportation by railroad.

Transportation by railroad

Express companies.

Express companies

Post, telegraph, and telephone.

Post
Telegraph and telephone

Other persons in transportation.

Other persons in transportation.

V. TRADE:

Banking and brokerage
Insurance
Real estate
Wholesale and retail trade

Elevators
Stock yards
Warehouses and cold-storage plants
Other persons in trade
Clerical assistants (industry, business, or profession not specified)

(C) SERVICE.

VI. PUBLIC SERVICE (NOT ELSEWHERE CLASSIFIED):
Public administration.
Federal officials and employees
State officials and employees
County officials and employees
City or town officials and employees
Public defense and maintenance of law and order.
National defense
(*a*) Army
(*b*) Navy
Maintenance of law and order
United States marshals
County sheriffs
City marshals
Constables
Detectives
Guards in parks, prisons, public institutions, and public buildings
Policemen
Probation and truant officers
Watchmen

VII. PROFESSIONAL SERVICE:
Professional service

VIII. DOMESTIC AND PERSONAL SERVICE:
Occupations not in industries
Laundries and laundry work

Under the three main categories of the proposed classification, there are eight general divisions. The grouping of the occupations of the people of a country under a few main heads is not without purpose or without advantages. Such a division enables one to study the workers and their occupations by large groups—to study groups the workers in each of which labor under somewhat similar conditions and in a somewhat similar environment, and have a similar station in life. It enables one to study, for example, the proportion of the workers of a country in each of these main industrial divisions, and the fluctuations in these proportions. This arrangement is very important also for the reason that, for

purposes of general study and general statement, it is possible to deal with large groups only. Therefore, it is well to preserve these main divisions, but they should not be allowed to interfere materially with the more important logical and practicable grouping of individual industries or occupations.

The number of main divisions in a classification should be determined largely by the natural groups into which the workers fall because of the similarity of their occupations, environment, station in life, and the industries in which they work. This number should not be so large—as it is in the English classification, which has twenty-three main divisions—as to preclude any brief and general statements as to large occupational groups; and it should not be so small—as heretofore in the United States classification—as to render accurate general statements impossible because each main division contains distinct natural groups.

In the United States classification there is need of a larger number of general divisions.* Our classification has been rendered illogical, unscientific and inadequate by the attempt to force all occupations and industries into five general divisions. In the proposed new classification an effort has been made to remedy this defect by increasing the number of general divisions from five to eight.

The title of the first division of the old classification, "Agricultural Pursuits," has been expanded to "Agriculture, Forestry, and Animal Husbandry," and the fishermen and oystermen have been transferred from "Manufacturing and Mechanical Pursuits" to this division.

The workers in the mining industries formerly were grouped with those engaged in agricultural pursuits, although the character of the work, and the environment of the workers and their station in life are quite different in the two cases. Later, they were transferred to the division of "Manufacturing and Mechanical Pursuits," not because they belonged there but because they must be put somewhere and they seemed to fit there a little less poorly than in the division "Agricultural Pursuits." This distinct group of workers, after having been tossed about for all these years, has at last found a home in the new division, entitled "Extraction of Minerals."

* Heretofore the United States classification has had fewer general divisions than have the classifications of most of the other leading nations.

Since 1870 one of the five general divisions in the United States classification has been "Trade and Transportation." Whether, in 1870, there was any valid reason for joining trade and transportation is doubtful. Today, it is certain that, aside from the pleasing alliteration, there is no more reason for joining trade and transportation than there is for joining trade and manufacture. In fact, it is highly probable that manufacturers are engaged in trade to a much greater extent than traders are engaged in transportation. Every manufacturer of products, whatever, is also a merchant to the extent of selling his own products. Not only is transportation a distinct division of our present-day industrial system, but, also, the occupations of the workers in it are quite distinct from the occupations of the workers engaged in trade. The proposed classification makes a separate division of transportation.

In the old classification, all public officials—national, state, county, and city or town—from the president to the most petty township officer, are grouped with professional classes, regardless of the fact that neither the official duties nor the intellectual attainments of large numbers of them entitle them to be called professional men. And, according to the census, all the men in our army and navy—employed mainly in national defense,— and all watchmen, policemen, and detectives—employed mainly in local defense—are engaged in personal and domestic service, notwithstanding the fact that their service is mainly public. In fact, "Domestic and Personal Service" has been made a dumping ground for "the odds and ends" of occupations which do not easily fall into any other class. Among others, we find here, 9,373 "Laborers (coal-yard)," 2,588,283 "Laborers (general)," 20,934 "Longshoremen," and 9,139 "Stevedores."

In order to relieve "Professional Service" and "Domestic and Personal Service" of some of these incongruent groups, and in order to bring together all those persons engaged in government service, and not elsewhere classified, the new division, "Public Service," was made.

Under the 8 general divisions of the classification outlined are arranged 123 industries and 4 service groups. In the further development of the classification, the method was to treat each industry, or each service group, as a separate unit,

and to give separately each of the important occupations under it. After enumerating all the important occupations in an industry, a class—entitled "Other Occupations"—was made for the unimportant occupations which, although definitely returned, are not sufficiently important to justify classifying each of them separately. At the end of each industry a class—entitled "Not Specified"—was made for all occupational returns in which the industry is given, but the particular occupation followed by the person is not specified. As an illustration of the manner of classifying the occupations of each of the 123 industries, and of each of the 4 service groups, the classification for one industry, "Printing and Publishing Establishments," is given below.

PRINTING AND PUBLISHING ESTABLISHMENTS.

Publishers and proprietors.
Officials.
Managers and superintendents.
Foremen and overseers.
Advertising and printing agents.
Bookkeepers.
Cashiers.
Clerks.
Collectors.
Purchasing agents.
Stenographers.
Typewriters.
Apprentices.
Bookbinders.
Compositors, printers and typesetters.
Cutters.
Decorators.
Designers.
Electrotypers and stereotypers.
Elevator tenders.
Embossers.
Engineers (stationery).
Engravers.
Errand and office boys.
Finishers (bindery).
Firemen.
Fitters.
Folders.
Gatherers.
Gilders.
Gold layers.
Helpers.
Inspectors.
Janitors.
Laborers.
Linotypers.
Lithographers.
Machinists.
Mechanics.
Numberers and pagers.
Pasters.
Porters.
Press feeders.
Pressmen.
Proofreaders.
Rulers.
Sewers and stitchers.
Shipping clerks.
Sorters.
Trimmers.
Wrappers.
Other occupations.
Not specified.

This form of classification seems to be a possible one, and one which will admit of reporting separately as few or as many

occupations in each industry as seems desirable and practicable. It is a form that will allow of expansion or contraction to suit changes in occupations and industries. If an occupation now relatively insignificant becomes of great importance, or if an occupation now healthful becomes, with changed processes, unhealthful, it can be reported separately, and those occupations which are of no special importance because of the skill, numbers, unhealthfulness, etc., of the workers, and which are too numerous to be reported separately, can be grouped together under the industry. If an important industry springs up it can be given a place under the proper general division; and, if thought best, new general divisions can be added.

The form of classification to be followed in the forthcoming census report on occupations can be determined, finally, only after the occupation returns are fully tabulated and the Bureau of the Census finds what it has to report; but it is probable that the tentative classification outlined in this article, modified somewhat perhaps, will be followed. Important changes in the census classification of a nation should be made only after careful and thorough consideration; and every such change should be thoroughly justified before being made. So far as practicable, comparability with past censuses should be preserved; and, where it can be done, the classification should be made to conform to the classifications of other nations. The object should be to make a classification that will be permanent, and one that probably will conform to an international classification in case one is adopted. It is especially important that consideration be given to the probable future industrial development of the country, and to the consequent probable increased demands that will be made upon any form of classification adopted. In the United States, it is evident that there will be a rapid and great increase in the number of our industries and the occupations of our working people. It is evident, also, that in the near future, either we must issue voluminous reports on occupations or else, in one form or another, report large groups of workers together. Whether, in view of all these things, the form of classification given here is the best possible one, is a question that should be considered. Will this form of classification meet the present and the probable future needs of users of occupation statistics;

and will it be adequate after the further development of our industries and the further division of labor?

Another question that must be settled before the report on occupations is written is this: In case this proposed form of classification is adopted, in how great detail should the Bureau of the Census report occupations? As stated in the beginning of this article, great detail of occupation is necessary to the intensive study of many of the problems relating to children, women, immigrants, negroes, etc., and, for the proper study of the questions of health, accident rates, insurance rates, etc., among the employed, such detail is indispensable. It is impossible for a national government to report its statistics in just the form each person may desire to use them; but if its statistics are reported in great detail, anyone can regroup them to suit his own purpose. An intensive study of the occupations in any industry is made possible by reporting them in detail. Finally, the more fully the occupations of a country are reported the easier will be comparison of its statistics with those of other countries, and, also, with its own past statistics, after changes in its classification have been made. On the other hand, space-limits prevent reporting the statistics in detail in many tables. In the forthcoming report on occupations, would it meet the need for greater detail to give one table for the United States, showing each industry with each occupation pursued in the industry, and with the workers in each of these occupations classified according to sex, nativity and age groups (the occupations to be grouped for the other tables)?

In its next report on occupations, the Bureau of the Census desires to supply, so far as practicable, such occupation statistics as students and statisticians will need in the study of the various problems in which they are interested. But, in order for it to do so, it must know their needs. One purpose of this article is to place the subject of occupation statistics and their classification before the users of such statistics, in the hope that in this way their valuable co-operation may be secured. It is only through the co-operation of the Bureau and the users of its statistics that the highest results can be attained. Criticisms and suggestions made now can and will be carefully considered by the Bureau of the Census. Those which may be brought forward after the publication of the report cannot receive due attention until 1920.

INDUSTRIAL ACCIDENTS, EMPLOYER'S LIABILITY, AND WORKMEN'S COMPENSATION IN MINNESOTA.

By DON D. LESCOHIER, *Expert Minnesota Bureau of Labor.*

The American people have come to realize that work accidents constitute one of the grave problems of the nation's life, and within the last three years twelve states and the federal government have appointed commissions to consider the compensation of injured workmen.* A large number of important publications on the subject have appeared,† and the sentiment both for adequate compensation and for efficient accident prevention is rapidly gaining an irresistible momentum. Minnesota took a unique place in the movement by passing a law that requires all employers except the railroads (which report to the Railroad and Warehouse Commission) to report their industrial accidents to the Bureau of Labor.‡ A similar law required all casualty insurance companies to report their industrial experience for 1907, 1908, and 1909 to the Minnesota Compensation Commission, but no use has been made of the reports.§

INDUSTRIAL ACCIDENTS IN MINNESOTA.

During the year ending July 31, 1910, 10,463 industrial accidents, 343 of which were fatal, were reported from the industries of Minnesota (including the railroads). Of the accidents 16 caused total disability and over 600 were serious.¶ The nature of the injuries in 2,000 non-fatal railroad accidents could not be ascertained, but New Jersey statistics suggest that probably one third of them were serious. This would increase the total number of serious accidents to about 1,300.

*Minnesota, Wisconsin, New York, Illinois, Connecticut, Maine, Massachusetts, New Jersey, Michigan, Missouri, Ohio, Washington. New York, Washington, Wisconsin, New Jersey, Ohio, and Kansas have already passed compensation laws, while Minnesota, Illinois, and Massachusetts have bills before their legislatures. The New York compulsory law has been declared unconstitutional, but an optional law passed at the same time is still operative.

† An article in "The Survey" of March 18, 1911, reviews these publications, while a digest of the report of seven commissions by P. Tecumseh Sherman is given in the same paper for March 4, 1911. A review of the Minnesota Bureau of Labor report upon which this paper is based may be found in "The Survey" of March 25, 1911, under the caption "Minnesota Leads."

‡ Chapter 235 Laws 1909.

§ Chapter 234 Laws 1909.

¶ "Industrial Accidents and Employers' Liability in Minnesota," Don D. Lescohier. Part II, Twelfth Biennial Report of the Minnesota Bureau of Labor contains the accident findings of the Bureau. Part I of the Biennial Report. "The Wage Earners of Minnesota," by Frank Hoffman, and Part III, Chapter I, "Wages in Minnesota," by Don D. Lescohier, contain supplementary material.

Forty-five per cent. of the killed and injured were married men, 83.78 per cent. were between 17 and 40 years of age, and 60.38 per cent. were either Americans or North Europeans. Fifty-one of the injured, including one total disability and one fatality, were females.

The mines had the largest number of accidents though the railroads had the largest number of fatalities. The wood industries, general contracting, metal manufactures, public utilities, agriculture and flour milling were the other more dangerous industries, though a surprising number of fatalities were reported from industries commonly supposed not to be dangerous, such as mercantile and printing establishments. The accompanying table classifies the injuries in the several industries.

INDUSTRIAL ACCIDENTS IN MINNESOTA—AUGUST 1, 1909, TO JULY 31, 1910—BY INDUSTRIES.

Industry.	Fatal.	NATURE OF INJURY.												
		Permanent Disablement.			Fractures.	Crushings.	Lacerations.	Sprains and Dislocations.	Burns and Scalds.	Injuries to Eyes.	Internal.	Frozen.	Unclassified.	Total.
		Total.	Serious.	Lesser.										
Railroad shops	4	..	1	11	17	234	204	50	40	197	5	..	1	764
Other railroad accidents	90	..	....	....	..	.....	.....	....	....	....	....	..	1,973	2,063
Lumber industries	55	1	23	53	82	382	430	72	16	51	6	..	....	1,171
Mining industries	83	10	23	17	150	2,341	689	394	124	436	22	5	213	4,507
Contracting	37	2	6	12	6	266	217	47	19	32	14	..	1	719
Public utilities	19	1	1	3	24	56	41	23	21	8	3	..	2	207
Agriculture	12	1	6	5	8	10	7	....	....	4	1	..	.....	54
Flour manufacturing	9	..	3	6	18	40	46	21	5	2	..	..	.....	152
Foundries and machine shops	7	..	7	27	42	125	96	....	26	4	2	..	.....	389
General manufacturing	(a)12	..	7	19	20	99	111	14	16	15	3	..	.....	316
Hotels and mercantile	4	1	....	....	9	17	16	3	1	....	..	..	.....	52
Livery and teaming	7	..	....	....	4	6	.....	....	....	....	..	..	.....	17
General labor	(b)4	..	....	3	13	14	9	3	3	....	4	..	.....	52
Total	343	16	77	157	453	3,590	1,866	635	271	794	60	5	2,190	10,463

(a) Meat packing, 1; shoe manufacturing, 1; printing 2; boxes and envolopes, 1; paper manufacturing 3; chemical manufacturing, 4.
(b) An elevator accident to a newsboy; a janitor who fell from a window; a street sweeper struck by an automobile; a watchman burned in a building.

The table shows that the industries of the state vary markedly in their accident hazards, and when we compute the number of accidents for each 1,000 men employed, the fact becomes still more evident. In the mines 4.05 men were killed for each 1,000 employed; in lumbering and woodworking, 2.28;

on the railroads and in the public utilities, 1.9; in general contracting and flour milling, 1.6; in metal manufactures, 0.44; and in general manufactures, 0.20. Similarly, of each 1,000 employed, 211 men were injured in the mines, 57 on the railroads, 47 in the wood industries, 30 in contracting, 26 in flour milling, 24 in metal manufactures, 19 in the public utilities, and 5 in general manufactures.

Equal diversity obtains in the relative proportions of the non-fatal accidents in the several industries that are serious. Five times as many men are non-fatally injured in the mines, in proportion to the number employed, as in lumbering and woodworking, but only one and a half times as many are seriously injured. Twice as many are non-fatally injured in the wood manufactures as in the metal manufactures, but only one and a half times as many seriously injured. Even more striking contrasts appear when we compare the relatively dangerous industries—such as woodworking—with the less dangerous industries, such as textile manufactures or shoe making.

But such comparisons reveal only the average risk of injury in the several industries. They are important in a study of the costs to the several industries of a compensation system, but served only as a starting point in a study of accidents that aims at prevention. For this purpose we must go deeper, and classify accident risks by occupations, machines and processes, we must discover the elements of hazard in each occupation and task, and separate the preventable and non-preventable causes of injury.

To illustrate. A study of occupational risks in the Minnesota mines revealed the fact that accidents were 24 times as numerous, in proportion to the number of men employed, among steam shovel pitmen as among miscellaneous laborers, 8 times as numerous among pitmen as among steam-shovel and stationary engineers, and 4 times as numerous as among trammers and locomotive engineers. On the same basis, 4 pitmen are killed or injured for each 3 brakemen, and 2 for every miner, blaster, or timberman, though these occupations furnish twice as large a proportion of the injured as of the total number of workmen employed. In the railroad

industry of the state, 34 per cent. of the fatal accidents during 1909, and 41 per cent. of the non-fatal accidents, occurred to trainmen, though these constituted but 13.7 per cent. of the total number of employees. The maintenance of way department, with 34 per cent. of the employees, had but 7 per cent. of the fatal accidents and 10 per cent. of the non-fatal; and the railroad shops, with 14 per cent. of the employees, 3.5 per cent. of the fatal accidents and 19 per cent. of the non-fatal. The fatal accident risks among trainmen in Minnesota in 1909 were therefore 15 times as great as among trackmen and 12 times as great as among shopmen; and the non-fatal risks respectively 10 times as great and 3 times as great.

Starting with this knowledge of occupational risks in any given industry we can analyze the processes of each occupation and discover its peculiar dangers, their causes, and the possibilities of their prevention. The pitmen in the Minnesota mines, for instance, were found to be especially exposed to falls "of ground or ore" by which 11 have been killed and 12 seriously injured during the past five years; to being run over by trains, by which 11 were killed and 3 seriously injured in the same period; and to being caught in steam shovel machinery while making repairs, in which manner 3 were killed and 5 seriously injured. The other 8 fatalities and 10 serious injuries during the five years were due to more or less occasional causes, though all of them resulted from dangers typical of the work—such as rocks thrown by blasts in other parts of the open pit (which is a great excavation in the surface of the ground with steam shovels working at various points cutting away the perpendicular banks and blasters loosening the ground with great blasts of black powder), rocks falling from shovel dippers, the breaking of shovel boom chains, or the bursting of a steam pipe on the shovel.

A further analysis of a single group of these accidents to pitmen may be utilized to show how careful investigations illuminate the problem of prevention.* The pitman is a part of the steam shovel crew. He works on the ground, laying the track on which the steam shovel is moved up closer to the bank as it cuts the bank away, cleaning the dirt from the

*"The Survey" of July 1, 1911, contains an article on the prevention of mine accidents by the author of this article, and succeeding numbers of "The Survey" articles on accident prevention in the woodworking, flour-milling, and agricultural industries.

track on which the train carrying away the dirt or ore runs; and fastening chains about large chunks which it occasionally is necessary to move by means of the steam shovel. It is while he is either cleaning the tracks or walking out of the mine that he is killed or injured (rarely injured) by the trains. The following cases are typical of the track cleaning accidents—On November 11, 1909, a track cleaner stepped upon the tracks and began cleaning away the loose dirt after a loaded stripping train had started for the dump. The train got stalled and backed down for a run. The shovel was running at the time and the deceased did not hear the approaching train. He was run down and killed.—On February 25, 1910, exactly the same thing happened. "Kriss was attending to his work," says the Mine Inspector, "and although the engineer blew the whistle and the headlight was burning, he neither heard nor saw the train approaching." Had the trains stood still for a single instant while a brakeman ran to the shovel and personally warned the pitman from the tracks, the accidents would have been avoided.

The "walking on the track" accidents occur because the tracks are the only paths out of the mines. The ground in the pits is extremely rough, being covered with boulders, jagged chunks of clay, mud puddles, and other things that make walking difficult. Workmen can hardly be expected, especially at the termination of their work, to clamber over such obstacles for several hundred yards to get out of the pit when there is a railroad track to walk on. These accidents, which occur not only to pitmen but to all classes of pit workers and took 23 lives in 5 years, could have been avoided by a path through the pit, at sufficient distance from the tracks to prevent chunks falling from the cars upon the heads of passersby.

The study of *how* accidents happen is closely related to that of *why* accidents happen. But the two questions have their origin in totally different attitudes toward the accident problem. The question, How do accidents happen? is born of the desire to prevent accidents; but the question, Why do accidents happen? is born of the legal struggle over the employer's liability for accident compensation. The first concerns itself with the causes of accidents with the purpose to discover which are eradicable and which are not; the second with the causes

of accidents with the idea of discovering whose fault was involved and who should bear the financial loss incident to the casualty.

An interesting tabulation of answers to the question, "Why do accidents happen?" was made possible by a clause in the Minnesota accident law which required the employers when reporting accidents to express their opinion upon whose fault, if anyone's, caused the accident.

MINNESOTA EMPLOYERS' OPINIONS ON THE PERSONAL CAUSES OF ACCIDENTS.

Cause of Accidents.	Number of cases.	Per cent. of all cases.
Hazards of industry	2,488	61.00
Contributory negligence	845	20.70
Hazard and contributory negligence	429	10.50
Negligence of injured	149	3.60
Negligence of fellow-workmen	127	3.10
Fellow servant and injured	42	1.00
Employer	4	.10
Totals	4,084	100.00

Thirty-nine per cent. of the accidents accounted for are declared by the employers to be wholly or partially due to the faults of workmen, either the persons injured or their fellows, and 61 per cent. to the hazards of the industry. Only 8 per cent. are ascribed solely to the fault of the workmen, but in 31 per cent. of the cases they are held to have contributed to the causes of the accidents. The most striking feature of the table is the statement by the employers that fully 60 per cent. of all the accidents that occur are due to dangers inherent in industry, a conclusion almost identical with that reached by the Bureau of Labor in a previous publication.* The Bureau of Labor would not agree, however, that these 60 per cent. are all unavoidable hazards of industry. On the contrary, somewhere from 10 to 40 per cent. of these accidents are as certainly preventable as the majority of the accidents due to personal negligence. More than 50 per cent. of the accidents that occur are certainly preventable.†

* "Industrial Accidents, Employers' Liability, and Workmen's Compensation," by Don D. Lescohier, Bulletin 1, October, 1909, pp. 26, 36.

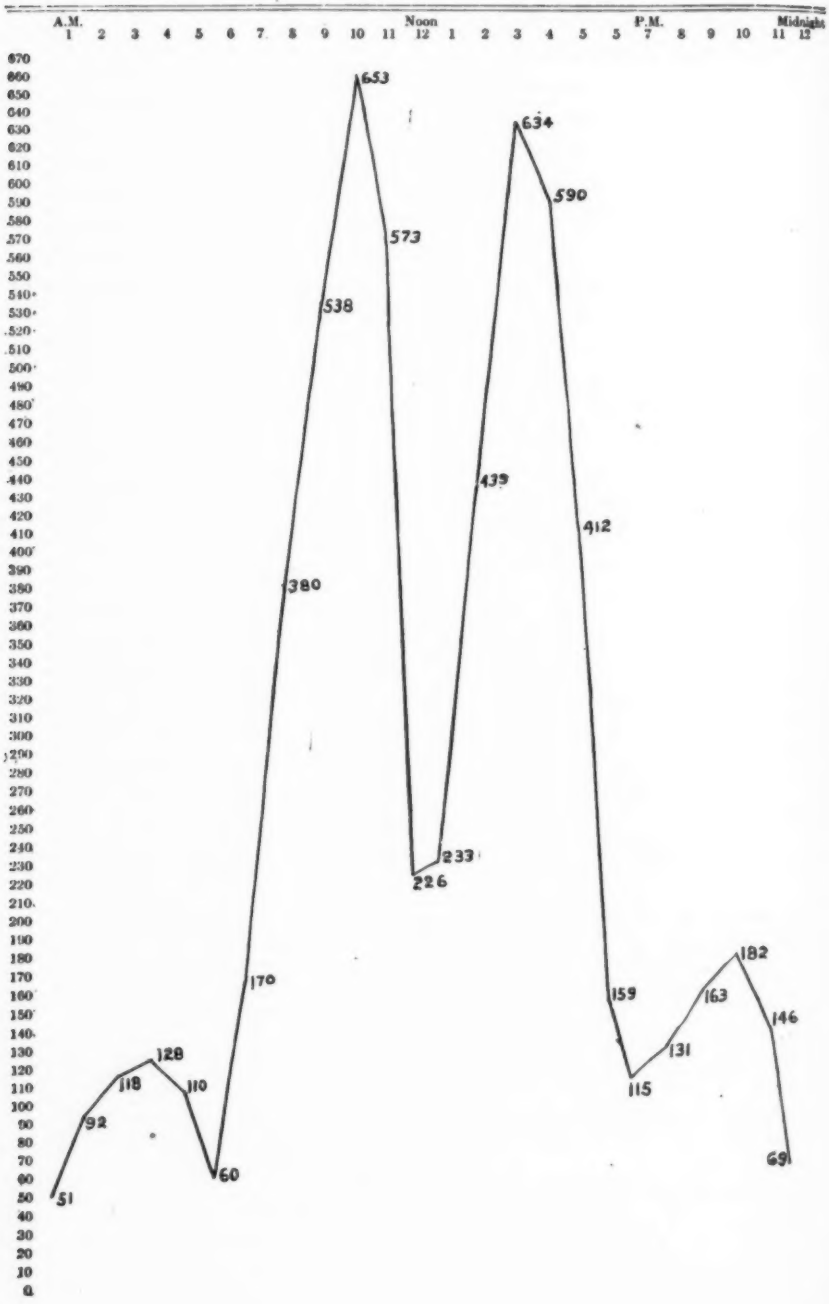
† The Minnesota Bureau of Labor is at present making a careful analytical study of all accidents reported since 1906 with the purpose of searching out all types of preventable accidents and the means of their prevention. The first of a series of safety bulletins to be issued by the department is already in press.

The accidents charged to the "hazards of industry" indicate that there are at least three general types of industrial hazards: first, those that operate with more or less regularity in particular industries, such as falls of ground in the mines, wrecks on the railroads, or falling trees in the lumber woods; second, those that occur frequently although not regularly, in a number of industries, such as the accidents on belts and shaftings which produce each year a number of fatal and serious injuries, but happen only occasionally in any particular plant or locality; and third, those that are exceptional and occasional, such as the bursting of a vegetable cooker in a restaurant, which permanently crippled a Minnesota domestic servant in 1909, or the bursting of a saw-mill boiler that took 5 lives in one catastrophe in 1908.

The principal personal causes of accidents found responsible in whole or in part for the 38 per cent. of the accidents attributed to the workmen, were youth, ignorance of the English language, incompetence, carelessness ranging all the way from a momentary inattention or forgetfulness to foolhardy recklessness, personal shortcomings like deafness or excitability, absorption in the work in hand which made the workman oblivious of approaching danger, fatigue, and nerve strain.

Wherever, as in the woodworking factories, a large contingent of workers less than 25 years of age was employed a relatively large number of accidents due to carelessness, recklessness, or thoughtlessness occurred; wherever, as in the mines, there was a large contingent of unskilled foreigners ignorant of the language and very commonly of the danger to which they were exposed a large number of accidents were found due to what was apparently inattention, carelessness, or stupidity on the part of the workmen, but really ignorance of the language and lack of experience and competence in the work. The accompanying chart, with its demonstration that the largest number of accidents occurs at 10 a. m., 3 p. m., 10 p. m., and 4 a. m., and the next largest numbers at 11 a. m., 4 p. m., 11 p. m., and 5 a. m.,—would seem to indicate that the absorption in the work and the high speed that accompany the middle and latter part of the working shift, together with the wearying of nerve and muscle by 3 or 4

CHART 1—HOURS AT WHICH ACCIDENTS OCCURRED. ALL INDUSTRIES. 6370 ACCIDENTS



hours of toil, are underlying causes of many of the lapses of care or attention that result in accidents. A tabulation of the hours of injury by individual industries yielded the same results as this chart shows for all industries.

Employers' Liability.

In the course of the investigation the Bureau of Labor investigated not only the legal principles of employers' liability, but the compensations obtained under employers' liability by 300 injured Minnesota workmen or their families. Fifty-four fatal accidents, 6 total permanent disablements, 50 permanent partial disablements, 50 serious temporary injuries (such as broken arms or legs), and 135 minor casualties were covered by the investigation. The representative character of the cases taken may be judged from the fact that the fatal accidents considered occurred in 41 different occupations, 28 industries, and nearly every section of the State.

In 27 (50 per cent.) of the fatal cases the dependents received no compensation at all; in 13 cases (24.2 per cent.) $1,000 or less; in 8 cases (14.8 per cent.) from $1,000 to $2,000; in 2 cases (3.7 per cent.) $2,500; and one each, $4,000; $4,256.94; $5,000 and $6,352. In the last case the deceased was a telephone lineman and his dependents recovered both from his employer and a lighting company whose wires killed him. The average net compensations in the 54 cases (*i. e.* the compensations over and above funeral, legal, and medical expenses incurred) was $536. Adding three years' wages to the expenses incurred on account of the accident, it was found that the average fell short by $1,445 of the average of a reasonable compensation for the families of the deceased.

The compensations for total permanent disability were—in three cases, nothing; in one $150; in another, $175, and in another, $4,500. The man who received $175 paid his lawyer $75. The $4,500 compensation was obtained by a Polish immigrant girl unable to speak English. Her hospital expenses, $1,700, and her legal expenses, $3,000, will consume the settlement before she is discharged from the hospital and leave her penniless.

Fifty cases of permanent partial disability were investi-

* Cf. statistics for Germany on same subject, which substantially agree, page 1134, Twenty-fourth Annual Report of the United States Commissioner of Labor, 1909.

gated. Ten lost in whole or in part the use of an eye; 6, a hand; 6, an arm; 9, a foot; 5, a leg; and 9, fingers. Five suffered miscellaneous injuries. Fourteen of the 50 received no compensation from the industry at all, and six others compensations smaller than their losses. Forty-four per cent. of the cases of permanent partial disability were found, therefore, to be uncompensated. In the cases where compensation was received the amounts varied greatly. For instance, the compensations for the loss of an eye ranged from $290 to $2,700; for the loss of a hand, from $405 to $4,200; and for the loss of a foot from $50 to $3,000.

The same things are true of the cases of serious, temporary injuries—such as broken arms or legs—50 of which were investigated. Six did not receive anything and four others only their medical expenses. These ten sustained losses of $2,009.27, or over $200 each. In 15 cases the injured received some compensation, but less than their medical expenses and wage losses—their net losses averaging $65.50. Seven workmen were paid full medical expenses and wages, and 18 were given compensation in excess of their expenses and wages.

Twenty-five (50 per cent.) of the workmen in the group sustained financial losses, seven (14 per cent.) were not financially affected, and 18 (36 per cent.) received an average compensation of $443 in excess of their losses. The average compensation above wages and medical expenses in the 50 cases approximated $100.

The workmen bore the whole of their financial loss in 51 out of 135 minor cases and 60 per cent. of the loss in 40 cases. In 33 cases their compensations equalled their losses, and in 11, exceeded them. Sixty-seven per cent. of the men suffering lesser injuries sustained financial losses, 24 per cent. came out even and 9 per cent. gained.

Workmen's Compensation.

A widespread realization of the injustices of employers' liability has led to the appointment of commissions in 12 states, and by the Federal Government, to frame compensation laws either changing the basis of recovery in cases of industrial personal injuries from negligence, or fault, to the risk of the industry, or at least to abolish those defences by

which the employers now escape liability. Seven of these commissions have already reported bills providing that workmen shall collect definite compensation proportioned to their injuries and without proving their employers' negligence and three states have passed compensation laws.*

A significant feature in these bills is the fact that they make compensation depend upon and vary with wages. The man earning $20 a week receives twice as much compensation for injury as the man earning $10, though maximum and minimum limits of compensation prevent the wage rate from carrying the compensation above or below certain totals. This characteristic of the laws is a distinct departure from the practice under employers' liability, where the amount of compensation is determined by the caprice of a jury, except as limited by statute in certain states. Wage losses may be considered by the juries in arriving at the damages to be awarded, but wage losses do not definitely determine them.

The Minnesota compensation bill, for instance, provides that for fatal injury 50 per cent. of the deceased's wages shall be paid for 5 years to his dependents, not to exceed in the total $3,000; for total permanent disability, 70 per cent. of the injured's wages but not more than $7,000; and for the loss of one limb or eye, 57.5 per cent. of wages but not more than $5,700. Lesser injuries of more than two weeks' duration are to be compensated by 50 per cent. of wages during disability.

The dependents of 48 men killed recently in the several industries of Minnesota would have received under this code: In 5 cases (10.4 per cent. of the 48) less than $1,000; in 13 cases (27 per cent.) from $1,000 to $1,499; in 19 cases (39.6 per cent.) $1,500 to $1,999; in 3 (6.25 per cent.) $2,000 to $2,499; in 3 others, $2,500 to $2,999; and in 5 (10.4 per cent.) $3,000. More than 37 per cent. of the dependents, therefore, would receive less than $1,500 and 77 per cent. less than $2,000. It is evident that a $3,000 maximum based on wages does not mean a $3,000 compensation in very many cases. The benefit accruing to the workmen from a compensation law would therefore consist in every family being assured some compensation rather than in the raising of the compensations to a high figure.

* See first footnote.

The computation that follows, based upon the Bureau of Labor's study of wages in 1910, shows what would be received by the wage earners of Minnesota under the compensation code, with a comparison of the amounts that would be received at the same rates of pay in six other states under the bills proposed by their commissions.

COMPENSATION FOR DEATH UNDER PROPOSED COMPENSATION LAWS.

Wages per week.	Per cent. of wage earners.	Compensations under Proposed Compensation Laws.						
		Minn.	New York.	Wisconsin.	Ohio.	Illinois.	Mass.	Kansas.
$6.00	1.5	$ 780	$ 936	$1,500	$1,500	$1,500	$1,200	$1,200
7.50	8.0	975	1,170	1,500	1,500	1,500	1,200	1,200
11.00	27.5	1,430	1,716	2,288	1,980	1,716	1,650	1,716
13.50	35.0	1,755	2,106	2,808	2,430	2,106	2,025	2,109
16.00	13.0	2,080	2,496	3,000	2,880	2,496	2,400	2,496
20.00	8.0	2,600	3,000	3,000	3,400	3,000	3,000	3,120
24.00 and over	7.0	3,000	3,000	3,000	3,400	3,000	3,000	3,600

COMPENSATION FOR TOTAL DISABILITY UNDER PROPOSED COMPENSATION LAWS.

Wages per week.	Per cent. of wage earners.	Minn.	New York.	Wisconsin.	Ohio.*	Illinois.	Mass.	Kansas.†
$6.00	1.5	$1,094	$1,242	$1,496	.....	$1,300 (a)	$1,192	.....
7.50	8.0	1,274	1,553	1,552	.....	1,300 (a)	1,192	.....
11.00	27.5	1,989	2,277	2,288	.....	1,430 (a)	1,680	.....
13.50	35.0	2,438	2,794	2,794	.....	1,755 (a)	2,012	.....
16.00	13.0	2,890	3,312	3,000	.....	2,080 (a)	2,396	.....
20.00	8.0	3,612	4,140	3,000	.....	2,600 (a)	2,980	.....
24.00	7.0	4,404	4,140	3,000	.....	2,600 (a)	2,980	.....
38.50	7.0	6,933	4,140	3,000	.....	2,600 (a)	2,980	.....

* 60 per cent. of wages for life.
† 50 per cent. of wages during disability.

A study of the compensations that would be obtained under the code by the workers in a number of dangerous industries and occupations is still more instructive. It shows how much the average rates of compensation would vary in the several industries with wage variations, For instance, though 37 per cent. of the wage earners of Minnesota would receive less than $1,500 for fatal injury and 37 per cent. less than $2,000 for total disability, none of the railroad trainmen would receive so little. Only 7 per cent. of all the workers of the state would be eligible for the maximum death benefit, but 30 per cent. of the railroad trainmen. Twenty-seven per cent. of all the workers would get over $2,000, and 93 per cent. of the trainmen. The average compensation for death

in all industries would be $1,755, but only 6.5 per cent. of the trainmen's families would be compelled to accept this amount.

The compensations of railroad trainmen under the code are given in detail in the table below, which is based upon the wage statistics on page 356 of the Minnesota Bureau of Labor's Twelfth Biennial Report (1909–10).

COMPENSATION OF RAILROAD TRAINMEN UNDER MINNESOTA COMPENSATION CODE.

Weekly wages.	Per cent. of trainmen.	Compensation for—		
		Death.	Total permanent disability.	Partial permanent disability.
$13.50	6.5	$1,755.00	$2,438.00	$1,950.00
16.50	24.4	2,145.00	2,977.00	2,440.00
18.90	8.7	2,457.00	3,413.00	2,796.00
20.40	10.4	2,652.00	3,719.00	3,160.00
22.50	19.3	2,925.00	4,055.00	3,320.00
25.50	8.8	3,000.00	4,600.00	3,760.00
28.50	5.8	3,000.00	5,143.00	4,210.00
31.50	4.7	3,000.00	5,677.00	4,650.00
34.50	8.2	3,000.00	6,200.00	5,100.00
37.50	1.9	3,000.00	6,755.00	5,540.00
40.50	1.3	3,000.00	6,933.00	5,700.00

It is evident, therefore, that while railroad trainmen are engaged in a dangerous industry they are in an industry which because of its high wages gets the highest degree of benefit rendered by a compensation system based on wages. The situation is much different in the other dangerous industries of Minnesots, such as mining and lumbering, or in the highly hazardous work of telephone and electric light linemen. For instance consider the following facts concerning the more dangerous mine occupations.

COMPENSATION OF MINE WORKERS UNDER PROPOSED CODE.

Occupation.	Average weekly wages.	Per cent. of all mine workers.	Compensation for—	
			Death.	Total disability.
Steam shovel pitmen-pocket men..	$13.50	2.00	$1,755.00	$2,438.00
Brakemen	14.40	3.12	1,882.00	2,600.00
Miners, blasters, drillers, timbermen	15.00	23.25	1,950.00	2,749.00
Dumpmen	12.00	2.45	1,260.00	2,167.00
Ship tenders	14.00	.23	1,820.00	2,538.00
Motormen, trainmen	13.80	3.20	1,795.00	2,502.00
Shift bosses	18.00	.43	2,340.00	3,250.00

Mine Workers of more than ordinary skill or those in the higher paid occupations, such as mine captains, steam shovel engineers, or diamond drill runners, who are both few in number and seldom seriously injured, would occasionally get the full death benefit, or a large disability benefit, but on the average the compensations for fatal injury to mine workers would be below $2,000, and the disability benefits in proportion.

The facts for the lumber industry are similar. The following table is based on the wages of the industry as a whole, rather than of specific occupations. It shows that 81 per cent. of the lumber and wood workers would receive less than $1,755 for fatal injury, and 57 per cent. less than $2,000 for total disability.

COMPENSATION OF WORKERS IN THE LUMBER INDUSTRY, UNDER PROPOSED CODE.

Average wages.	Per cent. of workers.	Compensation for—	
		Death.	Total disability.
$ 7.00	6.50	$ 910.00	$1,267.00
9.00	14.00	1,170.00	1,628.00
11.00	37.00	1,430.00	1,989.00
13.50	24.00	1,755.00	2,438.00
16.00	5.50	2,080.00	2,890.00
18.00	8.00	2,340.00	3,251.00
20.00	5.00	3,000.00	3,612.00

A similar computation for linemen showed that 53 per cent. would get less than $1,365 for fatal injury, 69 per cent. less than $1,755 and 96 per cent. less than $2,150.

An even more striking contrast is that between the compensations that would be received by the families of railroad trainmen and of railroad section men. We have not detailed statistics in regard to the number of section men killed and injured in Minnesota, though we know that they are numerous, but a study of New Jersey train accidents showed that 25 per cent. of the accidents to section men caused death (a total of 213 fatal accidents occurring in 20 years), and that one in every eight of the non-fatal injuries was a serious injury. The wages of these section men average about $1.40 a day in Minnesota which would entitle them, under the compensation code, to something like $1,050 for fatal injury, $1,450 for total disability and $1,200 for permanent partial disability.

REVIEWS AND NOTES.

CONFERENCES OF GERMAN MUNICIPAL STATISTICIANS.*

By Professor O. Landsberg.

A small group gathered at Berlin in 1879 to attend the first conference of German municipal statisticians. At that date the municipal statistical offices in the Empire numbered only eleven, nine of which were represented at the conference. Körösi came also from Budapest. Now the offices whose heads belong to the Association of German Municipal Statisticians number forty-one and the conferences, at first convened at long intervals, are now held annually.

The rapid development indicated by these facts could not have occurred without the increase in the number of great cities, but the fact that one city after another has established a statistical office shows clearly how the necessity and value of such an office are appreciated by municipal administration. Whoever examines the proceedings at these conferences will find that wherever they have met the city authorities have emphasized the indispensable character of municipal statistics.

It is not my object to show that this recognition is a well deserved reward for the tireless and unselfish support given by municipal statistics to all branches of municipal administration. I shall speak of the statistical work for the cities only so far as it has been discussed at the conferences. Their main theme has been the work of the annual publication, "Das statistische Jahrbuch deutscher Städte." As early as the second conference, in 1885, on motion of Neefe, it was resolved to prepare a statistical yearbook of German cities and the contents were outlined. At every subsequent conference the report on the yearbook has been the center of the program and its distinguished editor (Neefe) has worked unweariedly for the extension and perfection of the series. The number of subjects embraced has steadily increased and the number of cities has risen from 35 in the first edition (1890) to 84 in the seventeenth.

Closely connected with the work for the yearbook has gone a consideration of the statistics of municipal finance. The work of the committee on this topic presided over by Bleicher has forwarded the end in view so remarkably that a financial survey of the entire municipal administration is proposed for the eighteenth issue of the yearbook and can now be carried out. The committee has also examined the difficult question of the value of urban property as a basis for a comparative statistics of property. On this topic also the last conference, basing itself on the preliminary work of the committee, reached unanimous conclusions.

The work of these conferences in administrative statistics has been greatly aided by German municipal officials and their organization into

*This free and abridged translation of an article in the "Deutsches Statistisches Zentralblatt" for January 1, 1911, affords interesting evidence of the recent progress and present condition of municipal statistics in Germany.

the German municipal congress. A meeting between representatives of this congress and representatives of the municipal statisticians held at Berlin in 1908 revealed an entire unanimity in their objects and methods. The German municipal congress has established the statistical yearbook of German cities on a firmer financial basis by subscribing for a definite number of copies. It has also paved the way for permanent coöperation by adding three administrative officers to the committee of statisticians on financial statistics.

If the position of municipal statistics within the city has been established, the dispassionate chronicler cannot say the same about the position of municipal statistics within the state and empire. The resolutions adopted by the conferences between 1879 and 1903, and published in the 11th volume of the series, dealt repeatedly with the relationship between municipal statistics and state and imperial statistics; and since the latter date hardly any conference has passed without touching upon this topic. The program of the first conference brought it up, one topic proposing that "the tabulation of all statistics which the communes gather for the state should be transferred to the municipal statistical bureaus." Since 1902 the conferences have been attended by a representative of the Imperial Statistical Office and since 1909 by a representative of the Prussian Statistical Office. Municipal statistics no doubt form a part of the state. But as the state consists of dissimilar parts, statistical presentation should vary with the kind of division. For portraying simpler relations like those in rural districts the statistician will be satisfied with a smaller number of colors than he needs for a large city. Hence it cannot be deemed enough to treat the whole country statistically from a single point of view, regarding the great cities only as enumeration areas and not describing them as independent organizations.

These theoretical requirements have occasionally been satisfied by state statistics, as in the enumeration of place of work and place of residence at the Prussian census of 1900 and the return of residence in Saxony and Würtemburg. Still cases of this sort are exceptional and under the present development of state statistics must remain so. This makes a special treatment of municipal statistics all the more necessary.

The question of subsuming municipal statistics under imperial and state statistics has arisen of late not in connection with the census but with the statistics of prices. In fact state statistics of prices are nothing but municipal statistics. For example, the return of the retail prices of meat is important only within a city and becomes more important the larger the city and the more dependent it is upon remote districts for food.

This brings us to the second part of our subject, the statistics of the city as such. For this we need first of all to consider the great enumerations, like population censuses and industrial censuses, with which the conferences have been repeatedly concerned. At the industrial census of 1907 the municipal statisticians did not secure any recognition of their special interests. The conferences therefore limited themselves to giving repeated and thorough explanations regarding the work. Whoever in future sub-

jects the plan and execution of this census to a new examination will not overlook the discussion of Professor Schöbel (Chemnitz) at the conference.

Censuses also, especially those which extend beyond state limits, have been thoroughly discussed. Regarding the general principles of census-taking the conference in 1898 adopted the view that a law was needed as a guarantee of official support. At the last conference the statistics of servants were considered. In the excellent report on that subject an attempt was made to obtain from the census some statistical material of a general nature for the servant question. This is mainly a municipal question and finds its appropriate place in municipal statistics.

But the proper field of municipal statistics is housing statistics, especially the enumeration of tenements. This subject has been discussed before the conferences many times. In connection with it the statistics of land, of buildings and the occupations carried on in them, and of households and institutions have often been discussed. The registration of buildings constructed serves to carry on the study of the tenement market from one census to another. There are also enumerations of unoccupied tenements. Here, too, the conferences have obtained comparable returns. The results at present are compiled each quarter and published by the statistical office at Cologne.

Vital statistics have occupied the conferences but little. An exception is found in the statistics of causes of death. During the earlier period the system which grew out of the conference, the so-called "Flinzer-Lackner system," was often discussed. In more recent conferences the international, or Bertillon, system and later the systematic enumeration of causes of death proposed by the Imperial Health Office and the list of intermediate length developed therefrom for special purposes have been debated. On this topic Zimmerman of Cologne has rendered a permanent service and to him also the assembling of the monthly reports prepared by the different offices has been entrusted. But in other respects population statistics has long kept in the background at these conferences, the fourth conference, 1889, alone concerning itself with a thorough examination of the movement of population.

Recently, however, vital statistics has aroused great interest in two problems, infant mortality and the influence of natural feeding of infants upon it and the decrease of the birth rate, especially in great cities. As a result what Böckh, in the teeth of strenuous opposition, taught 25 years ago, has become common property.

In conformity with the development of social politics and the increase in the number of workmen employed by cities, statistical investigations regarding the working classes have been on the program from the first. The coöperation between municipal statisticians and the division of the Imperial Statistical Office devoted to labor statistics, for which a basis was laid at the conference of 1902, developed rapidly with very fruitful results through the work of Dr. Leo. The determination of the amount of employment based on reports of the beginning and end of sickness as first brought out by Silbergleit at Magdeburg was introduced in many other places in consequence of resolutions adopted in 1902. The utilization of the same

material for wage statistics was discussed in 1906. Returns of corporations were suggested as a basis for wage statistics in 1890 and the returns of employers under the Prussian income tax were debated in 1907. Thorough and careful returns regarding workmen's budgets led to an investigation of expenditures. This was decided upon at the conference at Stuttgart in 1906 and carried out with the coöperation of the Imperial Statistical Office.

With these fields of work the scope of these conferences is far from exhausted. The diversity of the material included in the municipal yearbook suggests many inquiries. Thus the statistics of scholars withdrawing from school grew out of the school statistics in the yearbook. This was limited by the conference of 1901 to the results of education and later, 1908, was extended to the occupation entered.

A subject which was placed on the program in 1910 for the first time but could not be given a hearing, statistical education in the German higher schools, must be mentioned. That statistics does not receive the treatment in the higher schools which its importance and its progress demand has recently been emphasized in various ways. I may mention here the argument of Bücher at the Magdeburg meeting of the Verein für Sozialpolitik. The Association of Municipal Statisticians, having among its members six teachers in such higher schools, cannot be denied the right to discuss this question.

This article gives only a very summary survey of the twenty-four conferences, but one thing appears, which all those who have had occasion to attend even one of them would confirm, namely that they are devoted to serious work. The close relations knit at these conferences between the members and with their guests from abroad representing municipal statistics at Basel, Zürich, Vienna, Budapest, Florence, and Amsterdam have borne much fruit. So the Association of German Municipal Statisticians, when it shall have reached its twenty-fifth conference, can look back over profitable work and forward with courage to the future.

WALTER F. WILLCOX.

Cornell University.

Note—The proposal to form a German statistical society has made a little progress in the last few months. The German Sociological Society has laid emphasis from the start upon the coöperation of statisticians and has elected a number of them to membership. At its meeting in October 1910 at Frankfurt-am-Main it resolved to establish a special section on statistics. Since statisticians can not attend every gathering which is related in any way to their diverse activities, the Sociological Society also resolved that the programs for this statistical section should be broad enough to include all questions of interest to statisticians, even though they do not fall exactly within the field of sociology. If this section is organized along these lines, it will be a step towards realizing the desire long expressed for a German association in which official statisticians, academic statisticians and all persons engaged in this profession may coöperate.

PLANS FOR PUBLISHING THE RESULTS OF THE THIRTEENTH CENSUS.

In the Thirteenth Census it is proposed to make the most general circulation of the results through bulletins which will be of two main types, general bulletins for the United States, and corresponding bulletins for each of the States. In the former, the results published for the United States as a whole will be subdivided by counties and where appropriate by cities. The four main divisions of the census enumeration, Population, Agriculture, Manufactures, and Mines, will thus be represented by a series of bulletins presenting by states the principal results of the census as rapidly as they can be tabulated. For each state a corresponding bulletin will be issued in which the facts will be presented by counties. As results are to be published as soon as available, the state bulletins will naturally come first in order of time.

In the field of population, the first bulletin for each state will deal with the numbers of the people, classified by place of residence. The second bulletin will deal with the principal elements of the population, sex, color, and nativity, place of birth, illiteracy and school attendance. A subsequent bulletin will treat of citizenship and marital condition. In the field of agriculture, the first bulletin will deal with farm acreage and property, live stock, and principal crops. In the field of manufactures, the state bulletin will cover the general field for each state, giving the number of plants, value of products, employees, materials, etc., with distinction of the principal industries. Other bulletins, whose contents are not yet fully determined, will be issued from time to time.

By far the greater number of inquirers as to census figures have heretofore found practically all the information they desired in the Abstract of the census. The proposed plan will give them this information in the State Compendium, together with special information regarding the state and county, or city, in which they live. While the bulk of the State Compendium will consist of the several bulletins assembled in one volume, it is proposed that it should include additional material important for the knowledge of the state, but not of sufficient volume to warrant the issue of a separate bulletin. The general bulletins for the United States will be designed to give information for all the states on the main results of the census enumerations. Another series of special bulletins is planned in which the treatment will rest less upon the distribution of the facts by states than upon an analysis of the topic treated. In such bulletins matter analogous to the subject treatment of such facts as sex, age, illiteracy, and the like, in the final census reports, will receive attention.

All the material of the general bulletins, special bulletins, and state bulletins, will be reproduced in the final reports as far as possible without modification of form, either of text or of tables. A new feature of the proposed publications will be the inclusion in the general tables of a large amount of comparative data, giving figures from earlier enumerations, and also a considerable number of relative figures, such as rates of increase, percentage distribution, and other familiar rates.

Broadly stated, the general distribution of census results, in their permanent form, will be through the medium of the State Compendiums. The final reports will be issued in smaller editions than heretofore, and, being mainly for general reference purposes, preference will be given to their distribution to libraries and institutions of learning. It is found that the needs of the majority of individuals will be met by the proposed State Compendiums, though, of course, there are many economists and statisticians who desire the final and complete reports. The general plan of the director of the census is to place all information really wanted in the hands of the proper persons, but not to give to each inquirer a vast mass of detailed material which he does not want.

MORTALITY—ACCORDING TO AGE AND THE DURATION OF ECONOMICALLY PRODUCTIVE LIFE.*

In this volume of some eighty-four pages, the author, Giorgio Mortara, has attempted to show the effect of variations in the death rates by ages and in birth rates on the duration of the economically productive human life. The scope of the work may perhaps best be indicated by a list of the topics discussed in connection with the main problem. The topical headings may be translated as follows: 1. Purpose and sources of the work. 2. The mortality-curve. 3. Increment of probability of death above age 55. 4. Variations in the probability of death, in space. 5. Variations in the probability of death, in time. 6. Probability, at birth, of surviving to age x. 7. Factors of group—or joint-mortality calculated from tables of survivors. 8. Mean lifetime. 9. Variations in mean lifetime, in time. 10. Probable lifetime. 11. Economically productive lifetime. 12. Sum of years lived by a generation between ages 0 and 15, 15 and 60, and 60 and w. 13. Distribution of deaths by age. 14. Economic results of decreases in mortality. 15. Economic results effected by decreases in mortality, and in birth rates. 16. Cost of production of the adult man.

In the elucidation of his theory, the author has drawn upon the vital statistics of all Europe, Australia, and even India and by dint of many calculations he has found certain coefficients which are intended to serve as aids in the approximate estimation of the cost of production of the adult man in various countries. These coefficients indicate

1st. The probability, at birth of surviving to age 20.

2d. The aggregate, group, or joint cost of a generation to age 20.

3d. The unit cost of a survivor to age 20.

4th. The cost of one year of economically productive life.

With these factors or coefficients it is only necessary to know the actual cost of the first year of life in any given country when by the application of the various factors to that figure the group, unit, or single year cost of the economically productive life follows. The author's coefficients have made all of the necessary alllowances for differences in mortality and in birth rates for the countries which he has considered. These tables should be of special interest to those concerned with questions relating to personal injury suits and to the problem of insurable interest, generally.

F. S. CRUM.

*"La mortalita secondo l'età e la Suruta della vita economicamente produttiva." Cooperativa Tipografica Manuzio via I; Porta Salaria, 23-A. Rome, 1908.